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W. E. KITTREDGE & J. G. FISCHER'S CAR COUPLING.

In our description of the Milwaukee & St. Paul Railroad shops last week, we referred to this invention, an illustration of which we give herewith.

The object which the inventors have had in view in designing it has been to make a platform for cars which would be safer to passengers in case of accident, and expose the employes to less danger in "coupling up." In addition to these features, it is claimed that the peculiar construction of the coupling allows but little longitudinal motion of the cars, and consequently prevents to a very great extent the sudden concussions which are so disagreeable.

The platforms for attaching these couplers may be made in the usual manner, but the inventors recommend that they be elevated so as to bring the buffer beams *Y, Y*, and the platform timbers *S, S*, on a level with the longitudinal timbers of the car body. Arranged in this way, they will resist concussion better than they would if they were not "on a line" with the main timbers of the car.

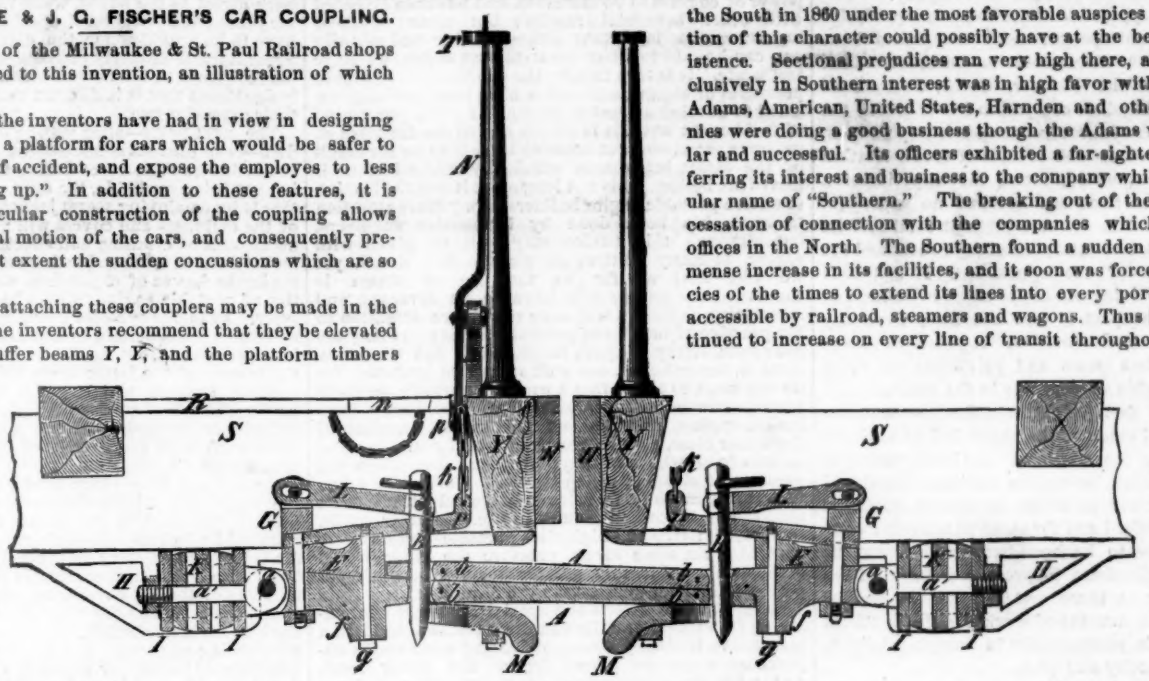


Figure 1. Longitudinal Section.

The coupling arrangement, instead of being a single short link, consists of two long and heavy bars *bb, bb*, attached by knuckle joints *a, a*, to the buffer springs *K, K*. The latter are each confined to two heavy wrought-iron frames *H, H*, shown better in the perspective view, figure 2. When the cars are coupled together, the two bars lap over each other, as shown in the cut, and are held together by the pins *B, B*. *M, M*, are two cast-iron mouth-pieces bolted rigidly to the car timbers and to the frames *H, H*. *E, E*, are abutments, and *P, P*, the coupling pin guides, both bolted to the coupling bars by the bolts *g, f*. To the guide, *P*, is attached a chain, *k*, which passes over a pully *p*, and is attached to the end of a laterally vibrating hand lever, *N*, which is held in place by a notched slot at *T*. In coupling up the cars the height of the bars *bb*, can be accurately adjusted by the lever *N*, so as to enter the mouth piece *M*. The coupling pins *B, B*, are attached to links, *L, L*, fastened by a slot and pin at *G, G*, *n* is a door in the platform through which the coupling pins can be withdrawn or inserted. From figure 2 it will be seen that each bar has two projections forged on it near the coupling pin. Their object is to guide the coupling bar by the contracted end of the mouth-piece of opposite car, so that the hole *b* will come to its place under the pin *B*. At the same time these projections will allow lateral motion of the cars, without causing the coupling bars to bind in the mouth-piece.

In "coupling up" the pin *B* attached to the top bar *b, b* is usually set so that its point rests on the edge of the hole. In bringing up the other car, the concussion will cause the pin to drop into the holes and couple the two cars. The second pin can then be inserted at the convenience of the brakeman. The whole operation of coupling, is performed without leaving the platform, and consequently with very little danger.

The platforms are brought very close together, so that passengers can easily step from one car to the other.

It will also be observed that it would be impossible for one car to "mount" the platform of the other, in case of collision without breaking both the coupling bars. So long as the longitudinal timber of cars are kept in line, there is little danger of "telescoping," therefore the arrangement of couplers we have described, must add greatly to the safety of railroad travel.

They have been in use on the Milwaukee & St. Paul Railway for six months on the entire passenger trains and are recommended by Mr. Merrill, the General Manager of that line, and the superintendents of the different divisions. Further information can be obtained by addressing the inventors, W. E. Kittredge & J. G. Fischer, Milwaukee, Wisconsin.

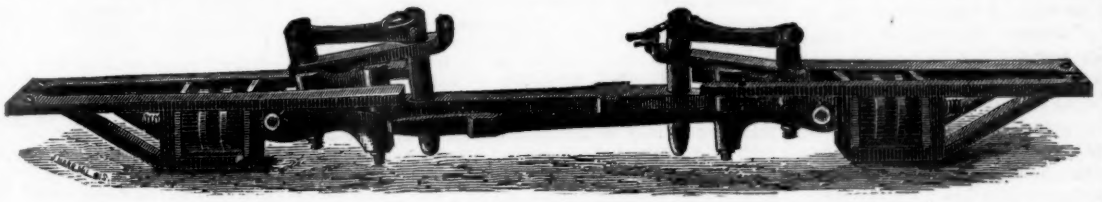


Figure 2. Perspective View.

THE SOUTHERN EXPRESS COMPANY.

MEMPHIS, Tenn., December 5, 1870.

TO THE EDITOR OF THE RAILROAD GAZETTE:

During a late tour throughout the Southern States, I was greatly impressed by the vastness of the enterprise exhibited by the Southern Express Company, and the importance of its services to the commercial community. The extensive ramifactions of this company reach every available point in the South, and to it there is attributable not a little of the prosperity of many sections of this country. It brings far remote regions into daily communication with the rest of the world and makes the comforts and luxuries, the art and literatures of the world accessible to people who otherwise would be almost separated from civilization; for it carries news and material to those places where the mail and ordinary freights often either do not go at all or come dragging along after weeks of delay. Hence it is a great developer of the industrial and commercial interests of the South, and has become an indispensable means of communication between its various sections. Hence I deem it a subject well worthy of the attention of your readers, especially as the vast extent of the enterprise has never been generally understood in the North, except by those whose business compels them to use its facilities frequently.

The Southern Express Company was established in the South in 1860 under the most favorable auspices that an organization of this character could possibly have at the beginning of its existence. Sectional prejudices ran very high there, and everything exclusively in Southern interest was in high favor with these people. The Adams, American, United States, Harnden and other express companies were doing a good business though the Adams was the most popular and successful. Its officers exhibited a far-sighted policy in transferring its interest and business to the company which secured the popular name of "Southern." The breaking out of the war soon caused a cessation of connection with the companies which had their main offices in the North. The Southern found a sudden necessity for an immense increase in its facilities, and it soon was forced by the emergencies of the times to extend its lines into every portion of the South accessible by railroad, steamers and wagons. Thus its importance continued to increase on every line of transit throughout the South, and with a foresight rare even in business men, its managers secured the contracts by which the company is now operating over an immense extent of territory.

I find by information from authoritative sources that the Southern Express Company is now operating on nearly twelve thousand miles of line, in which are comprised the best routes in the South. It connects at Louisville, Ky., St. Louis, Mo., Richmond, Lynchburg and Norfolk, Va., with the Adams Express Company; at Cairo, Ill., with the American Merchants' Union; and at St. Louis, Mo., with the United States Express Company. Through the Adams it connects with every express company recognized by that organization.

Though the Southern Express Company has nearly a complete monopoly of the business in the South, no complaint is ever heard concerning its management and general operations. This is because its charges are reasonable and compare favorably with those of any other company. Its tariffs are so regulated that the aggregate business shall pay a profitable percentage on the immense capital invested in the enterprise. This basis of low charges is founded on the advantageous situation it enjoys in its extensive privileges which also ensure prompt dispatch, protection to shippers and the most complete responsibility. It transports an incalculable amount of matter, and by its rapid delivery as well as quick settlement and adjustment of losses, charges, etc., maintains the confidence and patronage of the mercantile and all other classes of business men throughout its range of operation.

I find after careful examination of the system of the Southern Express Company that there are many features peculiar to the business of this section. The general system is peculiar, thorough and perfect in all its details, and is evidently the result of many years of careful study and experience. It is unintelligible to many expert accountants, yet it is so simple and comprehensive that the intricate business of the company can be exhibited daily on a total balance sheet and summary from every office and railroad line it employs. The general appliances of the company are worthy of notice. Each office in the South is thoroughly and systematically adapted to the requirements of its locality. The horses, wagons, harness, cars, chests and general furniture of the transportation department are of the very best quality and most substantial character. The employes are noted for their quick, active and prompt attention to business. The intelligence of the officers

is very notable, and the marked eminence of their social status throughout the South exhibits satisfactory evidence of their responsibility, general good character and excellence. It is considered of the utmost importance that the officers and agents should be honest and competent gentlemen, not only that the business may be done rapidly and with proper dignity, but also that the company may retain the confidence of the public. The completeness of the system of accounts it employs and the superior detective talent which is engaged to investigate losses and detect frauds, assist very materially to prevent its employes from acting dishonestly, aside from the delicate sense of honor which is cultivated, for detection and speedy punishment certainly follows him who dares to defraud the company.

As it has been supposed that the South is a profitable field for express enterprises, many companies have sought to establish themselves in business there. Within five years the Pioneer, Globe, Commercial Union, National and other companies have entered the field, but every one of them has suspended operations, and the stockholders, as well as lines of transportation over which they operated, found the experiment a costly failure. The Southern has had no successful rivalry. I find that it did not attempt to kill off its rivals by a reduction of rates, but always sustained the regular schedules of the opposition. It has such ample facilities for doing the entire express business of the South that, I suspect, it will not soon have any formidable rivals or competition. A principal reason for this is that it has leases and privileges on every railroad and available steamer line in the south.

Latterly, several fast freight organizations have established lines, and much of the heavy freight business heretofore done by the Southern, has been turned to these. Transportation by express combines speed and responsibility, and will no doubt always be employed where speed is required and for small parcels and valuables. There seems to be much harmony between the managers of the Southern Express and those of the fast freight lines; as there certainly should be, for there is a sufficient amount of work for the Southern to do to maintain it prosperously in carrying freights suitable for its capacity and plan.

This company has its chief offices in Augusta, Ga. Henry B. Plant is President, and Mr. M. J. O'Brien General Superintendent. The territory is organized into five districts, to each of which one assistant Superintendent is assigned. These have gained their responsible positions by earnest and laborious attention to business and are remarkable for their fidelity to the interests of the company, to whom also their services are invaluable.

Mr. Plant was sent in 1854 to Augusta, Ga., to superintend the Harnden offices. It soon became evident, however, that this company would be merged into the Adams, and that absorption took place at an early date. Mr. Plant then took charge of the Adams' routes, rapidly established agencies, and was an active spirit of its business in the South. This gentleman has been in the business twenty-six years, and is recognized as one of its most notable pioneers. He has filled every position and thus thoroughly fitted himself for the high position he now fills so well. A reputable jurnal has truthfully remarked of him:—"His success in life is "to be imputed to the secret of his giving close attention to his own, and not interfering with other people's business." He is very courteous, shrewd, and endowed with singular prescience in business matters. Of late years he has made his headquarters in New York most of the time, having yielded the practical management of the business to the Gen. Superintendent.

Of this gentleman, Mr. M. J. O'Brien, I take pleasure in saying that I have watched with interest his progress since 1858, when he held a subordinate place in Memphis, Tenn., in the Adams Express Company, and as he rapidly ascended to the position of first shipping clerk, money clerk, until in 1860 when he was promoted to the responsible trust of cashier in the New Orleans office. At an early day after peace was declared in '65 the company elected him to the position he now occupies, in which he has certainly done credit to the wisdom that comprehended his fine business qualities and his fitness for the management of a large and complicated business. He is handsome in person, elegant in dress, popular in manners, irreproachable in morals, attractive in social life, an active business man, rapid in movement, endowed with great vigor, and very prompt in his decisions. Many of your readers will, I think, recognize this as a not too flattering portrait of their popular friend, the representative man and active genius of the Southern Express Co. CLAUDE.

—On the 1st inst. Gen. George H. Chapman was appointed Receiver of the Louisville, New Albany & Chicago Railroad.

Locomotives vs. Portable Engines.

Although during the past ten or fifteen years locomotive construction has made steady progress, and although much has been done to render locomotives more durable and better capable of dealing with the heavy work they have now-a-days to perform, yet we fear that regarded purely and simply as steam users they cannot be said to have undergone any material improvement. The use of steel for tires, and many working parts, the adoption of larger bearing surfaces, and the use of improved means of lubrication, have lessened the cost of maintenance; the increased employment of the bogie in its various forms, and of appliances for giving the terminal wheels lateral play, have rendered engines better adapted for traversing curves, and have reduced wear and tear; and, lastly, the use of higher pressures of steam has enabled the power of engines to be increased, and has been attended with other beneficial results; but none of these improvements, important although they undoubtedly are, can be said to affect the statement which we have just made. It is true that by the employment of higher pressures of steam locomotives have been probably enabled to develop a greater amount of work per pound of fuel burnt; but this is simply due to the increase of pressure *per se*, and can scarcely be said to be the result of the steam being more efficiently utilised after it leaves the boiler. It is not long since it was the fashion to advise portable engine builders to pay more attention to what has been done by locomotive engineers, but although this advice may still be given with regard to many matters of constructive detail, yet we fear that as far as the use of steam is concerned the advice will have to be reversed, and locomotive engineers will have pay more attention to the practice of makers of portable engines. It may appear rank heresy to speak in this way; but the statement is, nevertheless, one well supported by facts. We do not mean to affirm that a common portable engine is a more economical steam user than an ordinary locomotive engine, but we assert that portable engines of the better class, such as are now sold by the leading makers to all who will pay for them, are, when the pressure of steam at which they are worked is taken into consideration, far more economical steam users than the best locomotives now in use. In other words, if the locomotive and high-class portable engine were worked at the same steam pressure the latter would give out a considerably greater amount of work per pound of fuel consumed, than the former.

Stripped of its wheels and special appliances for enabling it to travel on rails and draw trains behind it, a locomotive is simply a non-condensing engine with unjacketed cylinders placed below the boiler level, and with the distribution of steam effected by a common slide valve; and every portable engine builder of experience well knows that if he was to enter into a competitive trial with such an engine, he would be simply "nowhere." The experience of such trials has shown clearly the benefits derivable from the use of steam-jacketed cylinders, of separate expansion slides, and of arrangements for supplying the cylinder with steam in a perfectly dry state, and teachings of such experience are now never neglected by the leading makers of portable engines. Up to the present time the high pressure of steam used in locomotives, and the high piston speed at which such engines are worked, have enabled them to hold their own; but as these sources of economy are gradually being incorporated in portable engine practice, locomotives will, we fear, be left behind unless something be done to improve them.

One of the first points which should, we think, be attended to, is the adoption of arrangements for ensuring a supply of dry steam to the cylinders. There are, we know, many locomotive boilers which prime very little; but there are few which furnish steam in that thoroughly dry state in which it is so desirable to obtain it. In portable engines where the cylinders are situated on the top of the boiler, the carrying over of water with the steam is more easily prevented than when, as is the case with a locomotive, the cylinders are at a lower level; but inasmuch as in the latter instance the relative positions of the cylinders and boiler cannot be altered, special means must be resorted to for obtaining dry steam. Three methods of securing this dryness may be enumerated thus: 1. The steam may be superheated on its way from the boiler to the cylinders; 2. The boiler may be worked at a higher pressure than would otherwise be employed, and the drying process must be effected by wire drawing; and 3. Mechanical means may be employed for separating the steam and water, and preventing the latter from entering the cylinder. The first of these plans—that of superheating the steam—has been tried on locomotives with but very indifferent practical success; and, indeed, the temperature of the high pressure steam now used can scarcely be much increased without giving rise to difficulties with the packing of the glands and lubrication of valves and pistons. The second plan is one which is often adopted unintentionally, and it is no doubt effective within certain limits; but it can scarcely be said to be one worthy of extensive adoption.

There thus remains the third plan, of mechanical separation, and this, we believe, if properly worked out, will effect the desired results. It has long been known, that if a current of steam carrying water in suspension be suddenly diverted from its course, the momentum of the water will cause the latter to be carried forward in the direction in which the steam is moving before diversion; and if proper arrangements be employed, it can thus be collected and drawn off from the steam. "Separators" constructed on this principle have long been used by marine engineers and by some stationary engine builders with great success, and we believe their use on locomotive engines would be attended with excellent results. We may state here, that there is nothing new in this proposal to use separators on locomotives. More than twenty years ago, a separator, acting on the principle we have mentioned, was applied to the mouth of a steam pipe of a French locomotive by Mr. Edwards, and arrangements of a similar kind in modified forms have since been employed by other locomotive engineers. So far as we are aware, however, separators have only been applied to locomotives with a view of preventing the direct entrance of water into the steam pipe, and not with a view of further drying the steam on its way to the cylinders. The application of a separator to the mouth of a steam pipe, as was done by Edwards, is no doubt an excellent plan—far better, we believe, than any arrangement of screens and baffle plates—but in addition to this a second separator could be advantageously applied to the steam pipe just on entering the steam chest, or if this could not be conveniently done, fixed outside the smokebox tube plate in place of the usual T-piece. The latter situation possesses the advantage, also, that any water collected in the separator could be allowed to run back direct to the boiler, while in the case of a separator placed at a lowel level special arrangements would have to be provided for the discharge of this water. Separators, if properly constructed, offer no appreciable resistance to the flow of steam, and their cost is so insignificant that it is difficult to see any objection to their extensive use.

The next point—after getting dry steam to the cylinders—is to prevent condensation from taking place in the cylinders themselves during expansion. Superheating not being available, the only effective way of doing this is by employing steam jackets. Careful cleaning of the cylinders and covers will no doubt do much; but no amount of cleaning will effectively replace a steam jacket even in non-condensing engines working with a moderate degree of expansion, and this fact the practice of portable engine makers has long proved decisively. In inside-cylinder locomotives the tops of the cylinder are to a certain extent kept hot by the hot gases in the smokebox, but the dust and ashes which collect at the bottom of the latter soon found a non-conducting coating, through which but a slight transmission of heat te the cylinders can take place. In some outside-cylinder engines, also, the hot gases have access to the outer surface of the barrels of the cylinders; but the arrangement is rarely such that any free circulation of the gases can take place, and thus the effect is that those particles in immediate contact with the cylinders become cooled, and the latter merely become surrounded by jackets containing gases at a temperature far below that existing in the main body of the smokebox. The latter temperature is in fact so high that if currents of the hot gases were made to circulate freely round the cylinders the effect would be to carbonize all the lubricating materials, and cause the destruction of the rubbing surfaces. The application of a practically effective air jacket—or rather *gas* jacket—to the cylinders being impossible, and superheating being unavailing, it follows, as we have said, that recourse must be had to steam jacketing if we desire to prevent condensation from taking place in the cylinders during expansion.

The principal objections which have been urged to the application of steam jackets to the cylinders of locomotives are: 1st, that in the case of inside cylinder engines there is rarely room for such jackets, and 2d, that in the case of outside cylinder engines the employment of steam jackets would increase the weight at a point where in many cases an excess of weight already exists. The first of these objections is to a certain extent unanswerable, and there are no doubt many instances in which inside cylinders could only be jacketed over but a small porportion of their surfaces—so small in fact, as not to make it worth while to apply jackets at all. In the case of outside cylinder engines, however, the objection which has been raised is, we think, of but little importance. Portable engine builders now very generally cast their cylinders and steam jackets in one piece, and there is no reason why the same thing should not be done with locomotive cylinders. Under these circumstances the addition of a steam jacket to a 16 in. cylinder of a length suitable for 2 ft. stroke should not increase the weight of the casting more than about 2¼ cwt. In the case of bogie engines having the leading wheels well forward such an increase of weight would of course, be of no importance; while in the case of engines having considerable overhang at the front end still lighter steam jackets might be formed by inserting a steel bush, say, ¼ in. thick in each cylinder, the cylinder casting being chambered out around the bush to form the jacket. Steel linings or bushes have been applied to cylinders in this way by at least one firm of portable engine builders, and they have been found to wear exceedingly well.

In whatever way the steam jackets are formed, however, it is essential that they should be supplied with steam at the full boiler pressure, and that they should be kept clear of air and of the water arising from condensation; and it is in the fulfilment of these latter conditions that the chief practical difficulty of applying steam jackets to locomotive cylinders appear to us to consist. It being supposed that the steam jackets are completely distinct from the valve chests, a small pipe led to each direct from the boiler would, of course, serve to keep them supplied with steam at the full pressure; but to get effectively rid of the water arising from condensation is a more difficult affair. It would of course be easy to fit jackets with blow-off cocks to be opened occasionally by hand, but such an arrangement would have the defect of being dependent for its efficiency upon the attention of the driver or fireman, and this we fear could scarcely be trusted for such a matter. A self-acting steam, or rather water, trap would no doubt serve the desired purpose better if it could be depended upon, and probably some form of steam trap now in use could be made available for the purpose, care being taken that the hot water blown off is delivered into the tanks. Probably the best plan, however, would be to allow the water from the jackets to drain down into a small tank, and to place either in this tank or in immediate connection with it, a small pump kept continually

at work so as to return the water at once into the boiler. This pump would, of course, have the full boiler pressure on both the suction and delivery side, and the work it would have to do therefore would merely be to lift the water from the collecting tank level into the boiler.

The question will probably be asked by some locomotive engineers, whether the additional economy obtainable by the employment of steam jackets is such as to warrant even the slight additional cost and complication which the use of such jackets involve? To this question a reply in the affirmative may in most cases be unhesitatingly given. Of course there are some locomotives employed on duty which necessitates their being almost always worked nearly in full gear, and under such circumstances the use of steam jackets would effect but very little saving. In all cases where engines are employed on work permitting them to be run with the steam cut off even as late as two-fifths of the stroke, however, the employment of steam jackets will be found to result in a marked advantage; and, in fact, if the arrangements are properly carried out, a saving of some 8 or 10 per cent. in the steam used while working expansively may be depended upon. In countries where fuel is dear, such a saving would be of especial benefit.

We have now touched upon two points in which locomotive practice is open to improvement, and there are a few others connected with the use of the steam in such engines of which we also intended to speak here. The present article has, however, extended to such a length that we must postpone our further remarks until a future number. We shall, however, take an early opportunity of returning to the subject, and directing attention to the points to which we have referred.—*Engineering.*

Iron vs. Wooden Cars.

Some day, we hope not many years hence, passenger cars of iron will be the rule rather than the exception, and managers will find that this class of rolling stock combines more elements of safety and eventual economy than anything that is now in use. The extra weight of iron has been the principal reason why our railroad managers have looked with so little favor upon the different devices for using that metal for cars; but this reason is growing of less importance year by year as the weight of wooden cars is increased. At present many of the eight-wheeled passenger cars weigh eighteen or twenty tons each, and the new styles of cars demanded by modern luxurious taste, such as sleeping, palace and compartment cars, weigh fully one-half as much more, and it is within a few days we have read a description of one of these just finished for a Western road that weighed thirty-two tons. Most certainly it looks as though railway managers are getting to pay much less regard to the question of weight of rolling stock than they used to do, and will now look with more favor upon the efforts of inventors to produce a passenger car that combines great comparative safety to passengers and stability in its best sense. With the improved character of the permanent way and superstructure, and the improved devices for relieving the movements of rolling stock from the effect of jars and concussions incident to rapid locomotion, a greater weight upon each wheel is rendered practicable, that is, without perceptibly increasing the cost of hauling, or shortening the life of the rolling stock or the rail. Modern practice and experience show this to be the fact, and if managers continue to err in this direction let us hope that they will take the best means for utilizing the extra weight so as to give the passenger a reasonable assurance of safety from the dire effects of collisions where each broken piece of wood becomes an instrument of suffering and death, and in cases of fire where the wood, oil, paint and varnish became a funeral pile for the unwary. We believe in iron passenger cars because they can be made to last twice or thrice as long as the wooden cars do. While we have assumed that iron cars will weigh more than wooden ones, we by no means grant the fact. Because the first one or two iron cars, rough and uncouth in design, contained an undue amount of material and therefore of weight, it by no means follows that improvement cannot be made upon those designs, and we believe that if the combined railway managers should offer a liberal sum for the best design for an iron passenger car, competition among inventors would soon produce a device combining the best elements of strength, safety and economy. We know no reason why improvement in this direction is not just as possible as in any other branch of mechanical engineering; and when railway managers get over the notion that an iron railway car must of necessity be exceptionally heavy because it is made of that metal, and are willing to look with favorable eyes upon the effort to make a light and strong iron car, we shall find the battle in favor of greater safety and eventual economy more than half gained. Rusty prejudice is the greatest foe of all improvements in railway devices, and has been ever since George Stephenson successfully combatted it by the success of the locomotive. Meanwhile, let not railway managers forget to use and adapt the best safety devices for wooden cars. Let them see that these cars are strongly framed and guarded by all well proved improvements calculated to resist the effects of the hard service to which they are exposed. The next thing to having a better article is to make the best use of that which we have, and wooden passenger cars can be made comparatively safe, if managers are willing to pay a fair price for the skill and labor necessary to make them so.—*American Railway Times.*

—W. C. Tremain has been appointed Auditor of the Cincinnati & Iddianapolis Junction Railroad, in place of O. P. Lewis, resigned; and Mr. H. Coats Secretary, in place of W. W. Worthington, resigned.

Railway Expenditure—The Permanent Way.

Last week* we directed attention to the enormous capability of the locomotive as a money-earning machine, exceeding in this respect the powers of any other engine worked by steam. Provide it with a suitable road for the employment of its power, and the locomotive will, as we pointed out last week, produce every year a sum equal to twice its cost, and if well and carefully tended and looked after, the engine will live for twenty years, and will run in that time two and a-half millions of miles, hauling in its course millions of passengers or tons of goods and merchandise. The steam horse requires only a few pounds of coal, a few gallons of water, and some drops of oil to keep its bearings smooth and its joints supple; and provided with these, it can run eighty or a hundred miles without pausing on its way at a speed equal to that which the fleetest racer can sustain for a few seconds only; and with a power equal to five hundred horses. Of the money earned by this gigantic machine, but a comparatively small portion finds its way into the pockets of those who provide the means for constructing and building the locomotive. Before it reaches the shareholder there are ten heavy claims to be satisfied:—First, the cost of running the locomotive itself, estimated last week at £595 per annum; second, the repairs and renewals of the permanent way; third, repairs and renewals of carriages; fourth, charges of conducting the traffic; fifth, rates and taxes; sixth, Government duty; seventh compensation for personal injuries; eighth, compensation for loss and injury to goods; ninth, legal and parliamentary expenses; and, tenth, the large and all-embracing head of miscellaneous.

We propose this week to examine the charges incident to the permanent way, one of the four heads of expenditure connected with the carrying on of the railway business. The millions of passengers and the millions of tons of goods which are hauled by the locomotive pass over a pair of iron rails, and upon them, of course, there is an awful amount of wear and tear; and the cost of repairing and renewing these absorbs a very large portion of the gross earnings of the locomotive. These "parallel iron bars," as a distinguished engineer once termed the railways of the United Kingdom, would, if extended into one line, reach a distance of 21,656 miles, or approaching the total length of a girdle of the earth. Of this total, England and Wales has 16,766 miles, Scotland 3,336, and Ireland 1,554 miles. The aggregate length of the railways of the United Kingdom is 13,803 miles; of this, however, more than one-half has only a single pair of rails. The double lines have a total mileage of 7,853 miles, and the single 5,950. This does not include a large amount of mileage required for sidings and at stations, but the figures are sufficiently near to enable us to arrive at the formidable nature of the outlay upon this portion of the railway system. The weight of iron consumed in these rails—adopting the estimate of 70 lbs. to the yard—is 2,382,000 tons, and taking the cost at an average of £7 per ton, including the portion consisting of steel rails, the actual outlay upon the rails is £16,674,000. The following shows the proportion of double and single lines in the United Kingdom, the total cost of maintenance, and the average per mile:

	Maintenance.	Double.	Miles open. single.	Total	Cost per mile.
England and Wales	£3,087,856	6,566	3,634	10,200	3 3
Scotland	521,615	987	1,362	2,349	2 2
Ireland	154,758	300	954	1,254	123
	£3,764,2:9	7,853	5,950	13,803	

The proportion which this expenditure on maintenance bears to the outlay on locomotives, carriages, and traffic charges on fifteen of our principal railways, working upwards of 100 locomotives, is shown as follows:

	Maintenance.	Locomotives.	Carriages	Traffic.
Caledonian	£196,575	£2?3,787	£61,7 3	£230,650
Great Eastern	177,241	2 6,638	84,303	316, 64
Great Northern	201,131	327, 60	0,397	29?,209
Great Western	397,40!	478 454	194,081	554,598
Lancashire & Yorkshire	215,549	268.503	66,145	461,823
London & Northwestern	511,406	786.779	2 3.525	9 3, 50
London & Southwestern	186,262	202,83?	59,078	2 2,' 52
London & Brighton	107 604	185,271	4 ,900	1:2,19
London, Chatham & Dover	77,229	81,622	0,674	102,241
Manchester & Sheffield	75,663	109,574	36, 87	143,97
Midland	260,025	442,672	1 1,8 8	4 9,400
North British	193,200	178,402	8 ,6 6	221,064
Northeastern	350,477	613,639	2?1,517	366,733
Southeastern	121,473	157,7?8	44,' 0	200,092
Glasgow & Southwestern	91, 38	57,506	23,055	7 , 21

The total for each division of the United Kingdom is:—

England and Wales	3,087,856	4,473,?20	1,397.301	4,879,158
Scotland	521.615	551,926	192,052	594,120
Ireland	154,758	174.470	42,756	160,595

The rate at which the rails are worn out varies, of course, very considerably upon different railways. Iron rails which are passed over more frequently, and by heavier loads and at greater speed, will be crushed and worn out sooner than those where there is a small and light traffic. Thus on railways where the train mileage is the greatest in proportion to the miles of railway the wear and tear of the rails must be expected to be the greatest. A short time since some very careful experiments were made by Mr. Sandberg on this subject, and the results of his inquiries were embodied in a paper read before the Institute of Engineers in the session of 1868. His inquiries were directed to the results on five descriptions of iron. The mean of these results showed that the rails were crushed by the passing over them of a total of 4,232,000 tons, and were worn out by the transit of 5,980,000 tons. Resulting from this it was found that with the passing over of 3,000 trains yearly, each train composed of an engine weighing fifty tons and thirty wagons of ten tons, or a gross load of 230 tons, the effect would be that the rails would be crushed in 6 1-5 years, and worn out in 8 2-5 years. The quality of the rails is an important element in the calculation. One description of rails laid on the Great Northern line lasted during the passage of 65,000 trains, of a total aggregate weight of 13,000,000 tons, one-fourth part of the traffic passing at a speed of forty miles an hour, and the remaining at about fifteen miles an hour, representing work done equal to 276,000,000 tons at a speed of one mile an hour. Assuming, then, that the life of the rail is equal to 8 2-5 years, it follows that the expenditure spent upon repairs and renewals should be sufficient to replace the whole of the rails at the expiration of that time, so that the actual wear of the rails may be taken at something over £2,000,000 per annum. To this of course has to be added the very large item of labor and other incidental charges. The estimate is exclusive of the cost of renewals of sleepers, and the heavy outlay required on the earth-work bridges and bed of the river.

The more general use of the Bessemer steel rails have a very material effect in adding to the duration of the life of the rail, and as at present the price of steel is but little more than that of the best iron, there can be no objection to the more extended employment of that description of rail. The greater durability of steel has already been sufficiently tested to establish its superiority over the ordinary rails, but, as some facts stated by Mr Sandberg in the paper referred to will show, there is hope of seeing a very considerable reduction yet effected in this important item of railway expenditure. The experiments made in 1866 at the Chalk Farm station of the London & Northwestern Railway established the fact that each steel rail was found on an agerage to have worn out six iron rails. On the London, Catham & Dover Railway it had been found that after the passage over some steel rails of 9,375,000 tons the rails showed no appreciable sign of wear. At Stewart's lane new rails were required for the switches every three and a half months. The steel ones had lasted in good order. Mr. Mills, the engineer, expressed his opinion that the power of resisting wear and tear in steel rails amounted to fourteen or fifteen times that of iron rails. On the North London line twenty tons of Bessemer steel had been laid down, and over these there had passed the enormous number of 254,250 trains, estimated to weigh 38,137,500 tons; and the whole result of that traffic was the wear of only 3-16th of an inch of the rails. On a portion of the Burlington line, near the Bricklayers' Arms station, 400 yards of steel rails had been laid, and over it had passed 16,500,000 tons in three years and eight months. The result was a wear of 1-16th of an inch. The iron rails adjoining were worn out in 16 months with a traffic of only 6,000,000—the average speed of the loads being the same in both cases.

Mr. F. Stileman estimates that the total annual cost of maintenance and renewals of the permanent way of railways was above 9 per cent. of the gross receipts, and in the year 1866 it amounted to £3,466,668. The estimated tonnage of rails laid in main lines was 2,438,520 tons, and taking the life of the iron at ten years, it would require 243,852 tons at a cost of £7 per ton, equal to £1,706,964, to be expended annually; if renewed with steel rails, lasting double the time, 121,926 tons would be required, which, at £11 per ton, is equal to £1,341,186, showing a saving of £366,778, or nearly one per cent. of the gross railway receipts. Since this calculation was made, the price of steel rails, owing to the expiry of Mr. Bessemer's patent is very much less, the price now being under $10 per ton. It would follow, therefore, that the substitution of the steel for the iron rails will be attended with very substantial benefits to the railway interest.—*London Railway News.*

* Page 108, Vol. II. of RAILROAD GAZETTE.

—The following is given in the New York *Tribune* as the argument of Commodore Vanderbilt to show why the New York Central Company should not pay the usual 5 per cent. tax on dividends on the 80 per cent. scrip dividend declared last year, which the United States revenue officers now demand:

"Commodore Vanderbilt declares the issue of scrip was not a dividend, and did not even represent improved value of property, as the road was worth no more now than before. It represented the improved management of the road under the present direction, which has been able to work it at much less expense than ever before. The money thus saved has paid increased dividends upon which the Government has always received its tax. But as the road would sell for no more money now than before the present direction, which assumed control, and this scrip only represents what the direction thinks the road is able to earn in the future (the dividends upon the scrip being contingent upon the earnings of the road), it is claimed by Commodore Vanderbilt and his associates that the Government has no lien upon the company, unless it refuses to pay the tax upon any dividends the scrip may be entitled to in the future.

"The time given by the Government for the payment of this tax having expired, and the business of the road being threatened with entire stoppage, a further extension of thirty days has been obtained in order that the Treasurer of the New York Central Railroad (Mr. Worcester) may exhibit evidence that will convince the Government of the injustice of pressing this demand. Commodore Vanderbilt declared that he did not want his property levied upon, but would submit to any trial, either in the United States Courts or before any impartial tribunal, confident that he could maintain his course."

Baron von Weber's Experiments on the Stability of Permanent Way.

[CONTINUED FROM PAGE 220.]

Experiments to determine the power of permanent way structures to resist the loosening of the rails from the sleepers. It is remarked by Baron von Weber that in investigating the stability of the connection between rails and sleepers, it has to be borne in mind that the resistance of the rails to displacement depends upon three things, viz: First, the holding power of the fastenings (bolts, spikes, &c.), by which the rails are secured to the sleepers; second, to the increased friction between the base of the rails and the sleepers which is caused by a load standing on the rails; and, third, by the friction between the rails and the wheels, this friction causing the axles to form ties between the two lines of rails on which their wheels rest. It will thus be seen that the gauge of a line of rails is preserved not merely by the fastenings securing the rails to the sleepers, but also by other forces of considerable importance acting both on the top and bottom of the rails.

The passage of the rolling stock is considered by Baron von Weber to produce on the rails the following effects;

1. Under all circumstances a vertical pressure tending to force the rails into the sleepers, the latter yielding to this force in all cases where they are not made of materials of very high resisting powers, such as stone or iron. Wooden sleepers are of course compressed by the vertical pressure of the trains, and one point to be determined, therefore, is:

(*e*) To what extent are sleepers of various forms and materials compressed by the loads acting on the rails?

2. There is a horizontal pressure resulting, in the case of curves, partly from centrifugal force and partly from the rigidity of the rolling stock, and, in the case of straight lines, from the oscillation of the vehicles. This horizontal pressure—which may, however, change into a pressure acting at a more or less acute angle to the surface of the sleepers—tends to alter the position of the rail on the sleeper in two ways, namely: first, by shifting the rail on the sleeper without altering the inclination of the former; and, second, by canting the rail and causing it to turn on a point situated more or less near to its outer edge according to the compressibility of the sleeper. The first of these two kinds of displacement is resisted by the horizontal resistance of the spikes or other fastenings, by the friction between the wheel and rail, and by the friction between the base of the rail and the sleeper, and the question to be answered by the experiments relating to this kind of displacements, therefore, is:

(*f*) What power is required to displace a fastened and loaded rail horizontally on its sleepers?

The second kind of displacement just mentioned, or canting of the rails outwards, is resisted by the direct holding power of the fastenings connecting the rail to the sleeper and by the friction between the wheel and rail. The questions to be answered by the investigations relating to this matter, therefore, are:

(*g*) What force is required to draw the spikes out of the sleepers? and:

(*h*) What force is required to overcome the combined resistance due to the holding power of the spikes in the sleepers, and the friction between the rails and wheels?

The following sets of experiments were carried out by Baron von Weber in order to maintain answers to the above questions.

TABLE SHOWING THE RESULTS DURING THE SEVENTEENTH SERIES OF EXPERIMENTS.

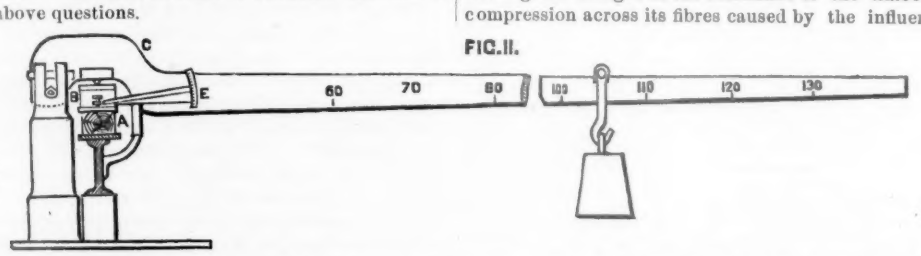
Compression of the timber of sleepers by a steady load of 190 centners (=14,747 lb.) upon a width of base of rail of 105 millimetres (=4.13 in.), and a width of sleeper of 300 millimetres (7.87 in.); this load being equal to a pressure of 453.7 lb. per square inch of surface of contact of rail sleeper.

Reference No.	Quality of Sleepers.	Unused Parts. Compression during the application of load.	Unused Parts. Permanent compression.	Old Bearing Surfaces. Compression during the application of load.	Old Bearing Surfaces. Permanent compression.
		mil. in.	mil. in.	mil. in.	mil. in.
1	Unused fir sleepers	8.5=0.138	1.4=0.055	9.0=0.354	1.4=0.055
2	Sleepers of the year 1866; fir timber; splintery loose	5.6=0.22	0.7=0.027	5.6=0.22	
3	" " 1866 " " solid	4.9=0.193	0.7=0.027	7.5=0.295	1.4=0.055
4	" " 1865 " " firm and perfect	4.2=0.165	0.7=0.027	7.7=0.303	1.4=0.055
5	" " 1865 " " "	5.6=0.22	0.9=0.035	6.3=0.248	1.4=0.055
6	" " 1864 " " average condition	5.6=0.22	0.7=0.027	9.0=0.354	4.2=0.165
7	" " 1864 " " very firm	3.5=0.138		6.0=0.236	7.2=0.283
8	" " 1863 " " "	4.9=0.193	1.4=0.055	9.0=0.354	4.2=0.165
9	" " 1863 " " "	4.9=0.193	2.5=0.098	14.5=0.573	4.2=0.165
10	" " 1859 " " average condition	6.2=0.243	3.3=0.130	21.0=0.827	5.6=0.22
11	" " 1858 " " "	7.1=0.279	0.3=0.008		
12	Oak sleeper, unused, average structure	1.5=0.059	0.7=0.027	6.3=0.248	2.1=0.083
13	" about ten years old	4.2=0.165	0.7=0.027	3.1=0.122	
14	" " "	5.0=9.197	0.7=0.027	7.2=0.283	

In carrying out the experiments made to determine the compression of the sleepers under steady loads, the following plan was adopted: Pieces of timber 2 ft. 11½ in. long were cut to the average thickness and width of the sleepers used by the Saxon State Railways, these pieces of timber being cut partly from new sleepers and partly from sleepers which have been in use. These pieces of timber, were placed under a lever press by the aid of which a pressure of 10 tons could be applied, a piece of thin cloth being interposed between the sleeper under test and the bed of the press, so as to give to the former an even bearing. Exactly as a rail rests upon a sleeper, a portion of a rail a little longer than the width of the piece of sleeper under trial was placed on the latter, and the pressure was then applied on the top of this piece of rail. The compression of the sleeper was indicated by means of a light lever which showed clearly deflections of a quarter of a millimetre (0.000097 in.). The arrangement of the whole apparatus is represented in the annexed Figs. 11, 12, and 13, in which A is the piece of sleeper under trial; B, the piece of rail; C, the lever of the press; and E, the indicating lever.

The chief objects of the experiments of which we are now speaking was to obtain some information concerning the changes in the resistance of the timber to compression across its fibres caused by the influences

FIG. II.



Experiments relating to question (*e*). In determining the resistance to compression of sleepers of various forms and materials, it appeared desirable to divide the experiments into two distinct groups. The first group was carried out to ascertain the amount of compression of sleepers of various materials, ages and conditions, caused by different but steadily applied loads; and these experiments were made by the aid of a lever press. The second group of experiments, on the other hand, was conducted for the purpose of ascertaining the amounts of the compression of the sleepers, and impression of the rails in the sleepers, caused by the passage of trains at different speeds; and these experiments could, of course, only be carried out on a line in actual use for traffic and by the aid of properly constructed and self-acting appliances. Of this second group of experiments, we shall give an account subsequently; and for the present we shall confine our attention to those constituting the first group.

to which sleepers are exposed in actual service. These influences are stated by Baron von Weber to consist chiefly in frequently repeated compression, washing by the rain, scorching by the sun, change from moisture to dryness, infiltration of insoluble combinations of iron due to the washing down of the rust from the rails into the pores of the sleepers, and penetration of particles of gravel, &c., these various influences producing at last a more or less complete destruction of the cellular structure of the timber. The resistance at different points of the sleepers which had been in use had thus to be carefully compared, and the comparative resistance of sleepers into which the bases of the rails had been pressed by the passage of trains, and of those upon which no impression had been made, had to be ascertained. The equal age of the timber at the places to be examined, and the presumptive similarity of the structure in the different parts of the same sleeper, increased the probability of obtaining really comparative data. The results recorded in the following table were obtained in the manner above described, this set of trials constituting the 17th Series of Baron von Weber's experiments.

In the case of the sleepers bearing the reference numbers 1 to 11 inclusive, the results recorded are the averages of five experiments, while the oak sleepers 12, 13 and 14 were single trials. The table thus gives

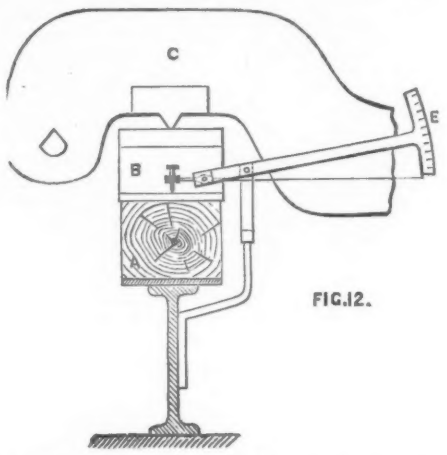
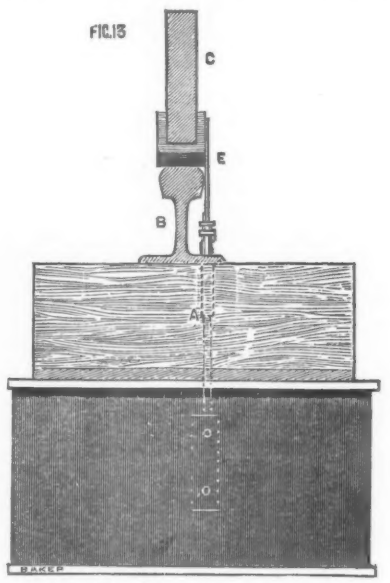


FIG. 12.

the results of fifty-eight experiments, a number sufficiently great to afford good data for comparison notwithstanding the difference in the quality of the timber and the difficulty experienced in obtaining equal bearing surfaces. It was found, in fact, that a fair and equal bearing was only obtained after the application of a considerable pressure had produced an apparent compression of one millimetre, and this amount ought, therefore, Baron von Weber considers, to be deducted from the quantities given in the table as the amount of compression under the action of the load.

The most striking result shown by the table is the deterioration of the sleepers under the influence of the

FIG. 13



traffic at the points where the rails rest upon them. Thus it will be seen that in the case of the fir sleepers the average compressions under the load, at the unused and old bearing surfaces respectively, were 5.3 and 9.7 mils.; while the average permanent compressions were 1.1 and 2.6 mils., the latter results being about double the former. In the case of the two last oak sleepers the averages were as follows:

	Unused Portion.	Old Bearing Surfaces.
Compression under load	4.6	6.7
Permanent compression	0.7	2.6

Another remarkable result is the actual amount of the compression, this amount averaging as much as 5.3 millimetres (=0.208 in.) for new and sound fir sleepers, and 9.7 millimetres (=0.382 in.) for fir sleepers averaging five years old. Baron von Weber considers that these results point to the necessity of employing rigid rails so as to distribute the effects of the pressure of the rolling stock as far as possible over a number of supports, and that they also show the advantage of employing sleepers of hard timber.

The results of the first group of experiments relating to question (*e*) Baron von Weber summarises as follows:

1. That sound fir sleepers 140 millimetres (=5.5 in.) thick and 200 millimetres (=7.87 in.) wide are compressed on an average one millimetre (=0.039 in.) by a load of 5.6 kilogrammes per square centimetre (=79.6 lb. per square inch); it being supposed that they have not before been subjected to such a load. At places where rails have already been bearing upon the sleepers for some time, this compression is increased to one millimetre for each load of 4 kilogrammes per square centimetre (=56.88 lb. per square inch.)

2. The action of the trains increases considerably the compressibility of the sleepers at the points where the rails bear upon them.

3. That the compressibility of wooden sleepers—and especially of fir sleepers—is so great, that it is necessary to distribute the pressure of the trains upon the sleepers as far as possible by the employment of rigid rails.

4. That increasing the number of sleepers in order to increase the carrying power of a permanent way, is, theoretically and economically, a wrong mode of obtaining that end.

5. That in the event of lateral pressure being brought to bear against the head of the rail, the resisting power of fir sleepers is not sufficiently great to prevent a canting of the rail consequent upon the impression of one side of the base into the sleeper. Hence momentary alterations in the gauge is allowed, these alterations disappearing, however, on the removal of the lateral pressure and leaving no traces on the spikes, sleepers, or rails.

6. The compression of fir sleepers under the bases of the rails is so great that the cellular structure of the wood is slowly destroyed and a cutting or indentation of the sleepers at the points of bearing takes place, this action being accelerated when the upper fibres of the wood have been more or less deprived of their elasticity by the action of the weather.

The above conclusions are justified by Baron von Weber's further investigations.

We have now to consider the second group of experiments relating to question (*e*), these experiments being carried out for the purpose of ascertaining the compression of the sleepers under the pressure of the rails on a line of rails in actual use. In carrying out these investigations it is first necessary—as the compression of the sleeper had to be measured by the deflection of the rails—to devise means for distinguishing between the actual compression of the wood and the sinking of the sleeper into the ground; and mistakes in the measurement had further to be prevented by securing the most perfect possible contact between the rail and sleeper. Finally the apparatus for measuring the deflection had to be made self-acting, as the great speed at which the rails were traversed by the rolling load rendered it impossible to obtain a direct reading from the deflectometer. The desired results, in fact, could only be obtained by carefully-conducted experiments, and by the aid of well-constructed apparatus. The solution of the problem as far as the atter is concerned appears to have been solved by the arrangements represented by Figs 14 and 15. Referring to the former of these figures it will be seen that close to the end of the sleeper, *a*, of which the deflection was to be ascertained, there was driven firmly into the ground an iron spike, *b*, furnished with a plate, *e*, upon which the small lever, *d*, moved with much friction. The distance from the point, *e*, of the lever to the fulcrum, *g*, was one-third of the total length, *e f*, so that the deflection of the point, *e*, was just one-half of that registered by the point, *f*, on the plate *c*. The bent piece of iron, *i*, was fastened by the spike, *b*, to the sleeper, and thus any deflection of the latter caused a corresponding movement of the lever, *d*.

FIG. 14.

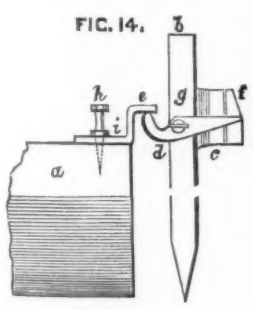
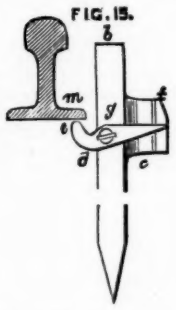


FIG. 15.



A similar arrangement to that just described was employed to register the deflection of the rail as shown in Fig. 15, the spike, *b*, being in this case driven close by the side of the sleeper, and the point *e*, of the lever being placed in contact with the underside of the base of the rail, *m*. The amount of the indentation of the rail into the sleeper could evidently be obtained from the difference of the deflections registered by the two levers, and as these levers moved upon their plates *c*, with much friction, there is every reason to believe that the maximum deflections were in each case accurately shown. The positions of the levers were marked upon the plates both before and after the passage of the rolling loads, the latter consisting of a tank engine having a load of 12 tons on the driving wheels. The speed at which the engine passed over the point where the apparatus was applied varied from about 19 to 28 miles per hour.

Of course, in carrying out this, the 18th series of experiments, the results of which are given in the subjoined table, there were chosen for trial such sleepers as were firmly bedded. The compressions registered are, as might be expected, generally smaller than those caused by the application of a dead load of 130 centners by the lever press; but Baron von Weber remarks that if the effect of the rigidity of the rail in modifying the application of the pressure be taken into account, there will be found a surprising coincidence in the two cases, and that a load of 130 centners* (=14,747 lb.) applied to a surface of 220 centimetres compresses sleepers 150 millimetres (5.9 in. thick, and of an average age (four to six years old) and average condition, about 4.3 millimetres, whence it may be assumed that in sleepers of the above thickness, a load of about 95½ lb. per square inch will produce a compression of one millimetre. The influence of the age of the sleeper and of the nature of the wood upon the compressibility is proved by the experiments made both with steady and rolling loads.

TABLE SHOWING THE RESULTS OF THE EIGHTEENTH SERIES OF EXPERIMENTS.

No.	Quality of Sleepers.	Age of the sleepers in years	Width of sleepers.	Deflection of sleepers.	Deflection of rails.	Compression of sleepers.
			mil. in.	mil. in.	mil. in.	mil. in.
1	Fir sleeper.	4	230 = 9.05	1.0=0.039	4.5—0.177	3.5—0.138
2	"	4	230 = 9.05	2.0—0.079	6.0—0.236	4.0—0.159
3	"	4	310 = 11.81	1.0—0.039	3.0—0.118	2.0—0.079
4	joint sleeper.	4	200 = 7.87	1.0—0.039	4.5—0.177	3.5—0.138
5	"	4	200 = 7.87	2.5—0.098	5.5—0.216	3.0—0.118
6	"	4	200 = 7.87	3.0—0.118	6.5—0.256	3.5—0.138
7	"	4	230 = 9.05	2.0—0.079	4.5—0.177	2.5—0.098
8	"	4	230 = 9.05	2.5—0.098	5.0—0.197	2.5—0.098
9	"	4	230 = 9.05	5.0—0.197	5.0—0.177	5.5—0.177
10	"	4	230 = 9.84	1.0—0.039	4.5—0.177	4.5—0.138
11	"	4	200 = 7.87	0.5—0.020	5.0—0.197	3.5—0.177
12	"	4	200 = 7.87	0.5—0.020	5.0—0.197	4.5—0.177
13	"	4	250 = 9.84	1.5—0.059	4.5—0.177	4.0—0.118
14	"	4	200 = 7.87	0.5—0.020	6.0—0.236	3.5—0.216
15	"	4	190 = 7.48	1.5—0.059	6.0—0.256	5.0—0.197
16	"	4	190 = 7.48	3.3—0.130	6.5—0.256	5.5—0.138
17	"	4	190 = 7.48	3.0—0.118	6.0—0.197	3.0—0.079
18	"	4	190 = 7.48	1.5—0.059	6.8—0.335	2.0—0.276
19	"	4	190 = 7.48	3.5—0.138	9.0—0.354	7.5—0.216
20	"	4	190 = 7.48	3.5—0.138	7.5—0.295	5.0—0.157
21	"	6	230 = 9.05	6.5—0.256	7.5—0.295	4.0—0.089
22	"	6	230 = 9.05	6.0—0.236	7.5—0.295	1.5—0.059
23	"	6	210 = 8.27	5.5—0.216	6.5—0.256	1.0—0.039
24	"	6	210 = 8.27	6.3—0.236	7.5—0.357	1.3—0.051

Baron von Weber's deductions from the second group of experiments relating to question (*e*) are as follows:

1. When the influence of the rigidity of the rail, etc., upon the transference of the pressure of the rolling load to the sleeper is taken into account, it may be considered that the compression of the sleeper itself takes place in the same manner under the action of either a steadily applied or a rolling load.

2. That the sinking of the well-bedded sleepers into the ground on which they rest is proportionately insignificant even under the action of considerable rolling loads.

3. That if the base of the rail has a bearing surface of 220 square centimetres (=32½ square inches) upon a sound fir sleeper between four and six years old, and 140 millimetres (=5.5 inches) thick; a load of 1,500 kilogrammes applied through the rail will compress the sleeper one millimetre. Or, in other words, a load of about 7 kilogrammes per square centimetre (=99.54 lb. per square inch) will produce the compression just mentioned on those parts of the sleepers which have already been frequently exposed to that pressure during a considerable time.†

* A load of 130 centners is the maximum load allowed, according to the laws laid down by the Association of German Engineers, to be applied to any one point of the permanent way during the working of the line.

† This power of resistance is necessarily greater than that deduced from the experiments with the lever press, when the rigidity of the rail exercised no influence.

As already stated, taking into account the influence of the rigidity of the rail upon the transportation of the load to the sleeper, the compression of the latter under steady and rolling loads may be taken as the same. Further evidence supporting these deductions is afforded by the experiments relating to question (*h*), of which we shall give an account in due course.—*Engineering.*

[TO BE CONTINUED.]

Railroad Law.

ILLEGAL TAXATION.

The Philadelphia, Wilmington & Baltimore Railroad Company operates a line of railway running from Baltimore to Philadelphia, passing through territory belonging to Maryland, Delaware, and Pennsylvania. It has three charters, one from each State, each State assenting to the charters granted from the other States. In 1869, the Legislature of Delaware provided for the levy and collection of the following taxes:

1. A tax of one-fourth of one per cent. of the actual cash value of every share of the capital stock of the company, the number of shares to be taxed in the proportion of the whole number of shares, and the proportion of the number of miles of the road lying in the State of Delaware bears to the whole length of the road.

2. A tax of 3 per cent. upon the net earnings or income received by the company, the amount to be taxed to be ascertained by the same rule of proportion of miles of road in the State to the whole length of the road.

3. A tax of $100 on every locomotive, used in the year by the company in the State of Delaware, and $25 for each passenger car, and $10 for each freight car used at any time during the year in the State.

A non-resident stockholder filed a bill in the United States Circuit Court for the District of Delaware, praying an injunction to restrain the collection of these several taxes. Justice Strong, of the United States Supreme Court, recently rendered his decision in the case, granting the injunction as against the tax on the locomotives, passenger and freight cars, but refusing it as against the other taxes. He regards the tax on locomotives and cars as a tax on passengers and freight in transit through the State of Delaware, and, therefore, unconstitutional.—*Chicago Tribune.*

LIMITATION OF TICKETS TO CERTAIN TRAINS.

The Boston *Transcript* of the 29th ult. has this account:

"Mr. William P. Moroney, in July, 1868, purchased of the ticket seller of the Cape Cod Railroad, at Sandwich, a ticket for New York, consisting of three coupons; the first coupon having printed upon it 'Sandwich to Middleborough;' the third 'Newport to New York,' there being no date upon the ticket or any limitation whatever. Mr. Moroney asked the ticket seller at Sandwich, at the time of the purchase of the ticket, if he could go on it on the morning train as far as Newport, spend the remainder of the day in Newport, and take the steamboat at night for New York, and received the answer that he could. He therefore took the first train at Sandwich, and, giving the conductor for his passage the first coupon, arrived at Middleborough, and entered the morning train on the Old Colony & Newport Railroad, and was carried to Fall River, the conductor punching the second coupon and passing him on without objection. At Fall River a new conductor came into the train who was accustomed to the through tickets from Boston to New York, which were limited to steamboat trains only, who informed Mr. Moroney that his ticket was good only on a steamboat train, and that he must pay the fare to Newport or leave the cars. Mr. Moroney was therefore ejected from the cars, and not suffered to return, although he then offered to pay his fare, after having protested against a rule which, if existed he had no knowledge or means of knowledge.

"The case was tried in the Superior Court for Suffolk, in the January term, before Judge Bockwell, who ruled that if the jury should find that the platntiff had no knowledge or reasonable means of knowledge of a rule of the railroad before entering the train, he was entitled to ride upon the ticket to Newport upon the regular morning train.

"The jury returned a verdict awarding Mr. Moroney $563 in damages.

"The defendants excepted, raising, among others, the following point:

"1. That the qualification of the judge that unless plaintiff had knowledge or reasonable means of knowledge, before entering the cars, he could ride on the morning train, was erroneous. That his knowledge was immaterial.

"The exceptions were overruled, and the following rescript sent down:

"The case shows that the ticket was issued by the authority of the defendent. It contains no notice or any restriction or limitation of the right which it purports to confer, and the jury have found that the plaintiff was not informed of the rule of defendant's road restricting that right. The plaintiff was therefore entitled to passage by any regular train for passengers."

—A company has been formed in California for the purpose of constructing, equipping and operating cheap narrow-gauge railroads in all parts of the United States. The trustees of the company are L. L. Robinson, S. F. Butterworth, C. J. Brenham, Isaac Friedlander, Irvin M. Scott, John Foster, F. McCrellish, F. A. Hihn and Phineas Banning. the capital stock is one million dollars, divided into ten thousand shares of one hundred dollars each. It is claimed that such roads can be constructed in California for $10,000 per mile.

A Mammoth Caisson.

Messrs. Webb & Bell, Engineers, of Greenpoint, L. I., have in process of construction a colossal caisson, destined to form a portion of the foundation of the New York shore of the East River Bridge, and upon which the tower on that side will rest. It will be in form and construction similar to the one launched from their shipyard in March last, which has since been placed in position and is now being built upon on the Brooklyn side of the river. The magnitude of these caissons and the combination in them of the various improvements which have from time to time been suggested by eminent men thoroughly conversant with the work, render them at once structures of the highest interest and importance to the engineering profession. The success which has attended the launching and fixing of the previous caisson, as well as its special adaptability for the purpose for which it was designed, leaves little doubt but that this one will also answer the end desired. There will be also a few slight improvements in this one which were observed to be wanting in the other, although to the ordinary observer no difference in construction will be noticed, the new suggestions having been made by Colonel Roebling with reference to the additional strengthening bolts to be used in fastening on the iron angle at the base of the inner bottom edge. The developments of these plans were left to Colonel Pain, who has placed them in the working drawings from which the structure is to be made.

This caisson will be sunk on the New York side, opposite the old east slip of the Fulton ferry, for which a space is being cleared by means of dredging machines, and it is hoped that with an ordinary amount of energy on the part of the contractors, the space will be cleared and the caisson placed in position in November next.

The caisson is in reality an immense chest, and when the term is applied to bridge building, it suggests a wooden box or frame of strong and massive timbers intended for laying the foundations of a bridge in such situations and in positions where the ordinary coffer dam cannot be used. In the present case, there being no rock foundation of a suitable nature on the New York shore for the employment of the dam, this structure will form a part of the foundation of the tower itself. The system adopted in its construction involves, in addition to the ordinary one, the principle of the pneumatic pile, which, in most cases, is a cylinder of a large size, forced down into position by atmospheric pressure. In the present instance the atmospheric pressure will be assisted by the continual excavation of earth, rocks and other matter, from beneath the mass of the caisson.

The principle of the diving-bell is suggested immediately one looks upon the drawing and tracings which Colonel Pain has prepared, The caisson proper, or the enormous chamber within which the work of excavating will be carried on, is rectangular in shape, 172 feet long, 102 feet wide outside, and 14 feet 6 inches high from the lowest edge of V, or lower angle. The sides are wedge-shaped in section, the lower edge being eight and a half inches and the upper eight feet three inches thick. The roof which rests on these sides is five feet in thickness, which leaves—the dimensions of roof and sides being allowed for—a working chamber of 172 feet by ninety eight feet ground area, and nine feet in height, or space for about eighty men to work. The whole is composed of oak and yellow pine timber, twelve inches square, the seams of which are "payed" with vegetable tar, in order to render them impervious to water, while between the outside layers of timber is a sheathing of tin between the two sheathings of felt, when renders them also air-tight. The sharp lower edges of the caisson are made very massive and strong in order to facilitate the sinking. The first course of timber is entirely of oak, and to this is bolted a cast-iron oval-faced shoe eight inches wide and three inches in thickness at its centre. Around this shoe will be placed an armor of boiler plates of rolled iron, extending three feet above on both sides of the chamber wall, the whole being strengthened by strongly made angle irons. At each corner in the second course of timber will be inserted a knee, or "bend" of hardwood, which is to extend twenty feet each way.

The timbers of the caisson are to be all bolted together vertically, horizontally, and diagonally with one and a half inch bolts, varying in length from two to seven feet. The bolts are to be placed not more than fifteen inches apart throughout the whole structure, the heads and nuts tightened by means of India rubber washers.

As this structure is sunk in its desired position sixty feet below tide mark, which is the same as the depth of the river's channel, additional courses of timber will be placed on the top to the height of twenty feet and then filled in with concrete, and when the whole mass has been fixed in its final resting-place the tower will be built on the solid foundation thus formed.

Six shafts of boiler plates pass through the roof of the caisson, the two outside ones being the excavating shafts, rectanglar in shape, and about seven feet in diameter. Next are two supply shafts, circular in form, forty-five inches in diameter, through which the workmen are to pass to the working chamber beneath. The last are two air shafts, or locks, also circular, and twenty-one inches in diameter, all the shafts being constructed specially with the view of safety and convenience. Through the air shafts the air will be supplied, or forced below by means of force pumps; the air will expel the water and enable the workmen to descend to the bottom of the river. A complete idea of the magnitude of this caisson can be readily had from the following figures: The length is 172 feet; width, 102 feet; height, 14 feet 6 inches; including superincumbent timbers and concrete, 32 feet 6 inches; total quantity of timber employed in its construction, 106,000 cubic feet; total weight of caissons before launching about 4,000 tons; weight of wrought iron bolts to be used 250,000 pounds; weight of rolled boiler plates and angles, 561,000 pounds; and it will also require about 200,000 feet of timber in order to launch it from the ways. A great number of men are working at it, and it will probably be finished before the time fixed for placing it in position. It will cost, when delivered to the Bridge Company, about $508,000.—*Engineering and Mining Journal.*

The Use of Maps in Locating Railroads.

From an article in the last number of the *United States Railroad and Mining Register* entitled "Railroad notes in Southwestern Virginia," (one of a series which we find very instructive and interesting), we extract the following criticism on the faults of ordinary State and county maps:

It is unfortunate that our railway system always keeps so far ahead of good maps. Many futile and some absurd schemes for new railways would be abandoned as soon as proposed, or set aside by sensible people upon the first consultation held over such a map of the region to be traversed as ought to be in the county towns and chief city of each State. How easy, for instance, it would be to see exactly where the new Shenandoah Railway is to run, if we had a scientifically constructed map of the Valley of the South Fork, lying between the Massanutten Mountain and the northwest slope of the Blue Ridge. As the finest deposits of brown hematite iron ore belong to the *base* of the Lower Silurian Limestone, and consequently lie up against the northwest foot of the Blue Ridge Mountain range, it is evident that a great railway ought to hug the southeast edge of the Great Valley as closely as the topography will permit. But in the absence of good topographical maps of Jefferson, Clarke, Warren, Page and Rockingham counties in Virginia, it will require extensive and expensive engineering surveys to determine whether any cheap line at all can be obtained in the broken region between the Massanutten and the Blue Ridge. And even engineering surveys will not tell the whole story. A topographical survey must be complete—not merely linear and experimental—to show all possible routes, and afford materials for comparisons beforehand. We should have such county maps as would permit us to tell *beforehand* into what sections to send engineering parties to survey experimental lines. Such maps can only be made by covering the whole country; by surveying every road and path with compass and odometer; by taking levels at every station; and by connecting the leveled stations with contour lines, ten or at least twenty feet apart. No map which merely shows roads and rivers is worth much; it is worth nothing at all for railroad-building purposes. No one can tell by looking at such a map whether a stream cuts deeply into soft rock strata, or soluble limestones, so as to leave steep walls; or whether it wanders meanderingly down a comparatively level plain. No one can form a proper idea, therefore, whether a railway engineer ought to follow the streams, or avoid them; nor whether, if he keeps away from the streams, he will probably find a level and feasible, or a broken and impractical upland; whether his upland will cost more for bridging and trestlework than his stream line would cost for cutting and embankment, or not. But a properly constructed county map would settle all such questions at a glance.

Then the absurdly irregular way in which map-makers jot down mountains affords a new embarrassment. Sometimes a mere water divide, which presents no obstacle at all to a railway, is laid down on a map as a mountain ridge connecting two parallel mountains, and of equal height with them. This happens frequently on the published maps of Virginia. They utterly confuse the topography, closing up what are open railway lines; while in other places actual mountain barriers, quite impassible to railways, are left out of the map altogether, permitting the engineer to think he has an easy road before him, until he is suddenly brought up all standing at the foot of gradients of 150 or 200 feet to the mile, and he has to back out from a *cul de sac*, the very existence of which he had no reason for suspecting, to recommence his surveys from points far in his rear, with all his time, and lots of money, wasted to no purpose and without excuse.

A curious instance of the mistake first mentioned may be cited in Montgomery county, Virginia, where those who choose to consult Colton's map of Virginia, Maryland and Delaware—decidedly the best we have, and a very nice map for tourist's purposes, but almost worthless for railroad men—will see that the "Allegheny mountain" is laid down as running *directly across* the Great Valley! And through the village of Christianburg!! It so happens that Christianburg is situated precisely like Chambersburg in Pennsylvania, in the centre of the Great Valley, only at a much higher elevation; for the floor of the valley is here much more elevated above the sea level than it is further to the northward. But it is still the same limestone valley that it is everywhere else between the Hudson river and the Georgia State line; and it is bounded here, as it is everywhere else, by the first of the Appalachian mountains on the northwest, and by the Blue Ridge on the southeast. Yet Colton's map puts the Allegheny mountain square across it; and one would suppose that the Virginia & Tennessee Railroad went through it by a tunnel, or over it by inclined planes. The only reason the map maker had for cracking on his clients' heads this unseemly joke is the fact that the line across the valley, along which he had portrayed this mountain, is actually the line of a water-shed between the streams *in the valley* which run north to the James and the streams *in the valley* which run south into New river. Because the New river is a branch of the Ohio, with its head-waters, in the Blue Ridge southeast of the Great Valley, and the James river is a branch of the Chesapeake, with its headwaters in the Allegheny (Appalachian) mountains northwest of the Great Valley—both streams crossing the Great Valley, but in different directions—the map-maker, not knowing what to do with the Allegheny mountain when it reached the New river, carried it all the way around the head-waters of the New River, east and south, butt into the Blue Ridge. The absurdity of the affair is enhanced by the fact that the Allegheny mountain is everywhere a mountain of Conglomerate and Coal Measures, and the Blue Ridge is a mass of immensely older, contorted, primary, gneiss, mica slate and granite rocks, full of magnetic iron and copper ores, not a trace of which has ever been seen in any ridge or section of the Allegheny mountains, from one end to the other.

The St. Charles Bridge Disaster Caused by the Defective Fastening of a Wire Rope.

The following account of the accident to the St Charles Bridge, by which fourteen men lost their lives will be interesting and should be profitable as a warning to those engaged in similar constructions. We take it from the St. Louis *Republican*.

The bridge which is being built by the St. Charles Bridge Company, a corporation in which the North Missouri Railroad Company owns most of the stock, is to span the Missouri at a point a little below the business portion of St. Charles. It has seven spans, four approach spans, 306½ feet each, and three spans of 318½ feet over the channel of the river. There are seven piers already built, and one in course of construction. The superstructure of two of the spans on the south bank has been completed, and false works or scaffolding had been erected as the preliminary step to placing the superstructure from the first pier on the St. Charles bank to the second pier in the stream. This superstructure is to consist of what is known as a Fink truss deck bridge. The span was one of the smaller ones. The false works were a Howe bridge truss supported on three pieces, and which was constructed of timber, but strong enough for the running of railroad trains over it had it been available. On the top of this truss was trestle work, rising thirty-seven feet and level with the proposed track. The distance between the spans of the bridge supporting the trestle-work was about sixty feet. The false works for this portion were finished last week, and were tested on Wednesday by the placing on them a locomotive and cars loaded with lumber, extending from pier to pier, and weighing, it is estimated, 150 tons. The test was made for the purpose of ascertaining whether a flood which had occurred had affected the stability of the three small piers, and not for determining whether the false works had been constructed of sufficient strength. The test was entirely satisfactory, showing as it did a deflection of not more than a quarter of an inch.

The mass of iron which created the smash on Friday was the first chord of the span. It was wrought-iron, worked in the form of a hollow column, was two feet in diameter, nineteen feet in length, and weighed four tons and a half. It was called the butt chord, and had been supplied by Garard B. Allen & Co. The chord was elevated to a height of some sixty feet from the ground, to the track on the trestle-work, on Tuesday evening, but by different hoisting tackle to that used afterward. It was placed on a small truck, and run out to the end of the track. Near to it there was a car on which there was a double-masted derrick and hoisting engine.

The block employed to hoist the chord, subsequently, was an ordinary sixteen-inch one, with a wire rope three-quarters of an inch thick, passed through it, so as to increase its bearing capacity six times. It was the manner of the fastening of this rope in the becket of the block which played so much michief. The end of the dead-line had been passed through a cone-shaped aperture in the plate, the strap is turned down into the upper and broader portion of the cavity, steel wedges driven between them, and molten lead poured into the interstices. This is the fastening usually adopted, and was thought to be secure. It had been made two weeks before, and the rope was a new one.

The work of placing the chord in position was proceeded with on Friday morning. A gang of 13 employes, under the direction of Captain H. S. Odell, foreman of the raising department, took a mass in charge and the wire rope began to tighten on the passive instrument of destruction. It was known that the work was to be attempted that morning, and quite a number of people had assembled on the bank to see it effected. One end of the chord had to rest on bed plates on a small tower of the second pier and lie horirontally. The mass was raised from the truck on which it had been placed, and was elevated, it is supposed, a little too high. Still no danger was anticipated.

While there was no apparent danger to human life, there was cause for fear that the stone work on the top of the pier would be battered by reason of the swinging of the chord against it, and Odell shouted to Howard, the engineer at the brake, to stop hoisting. Particular instructions had been given not to deface the pier, and Howard appears to have had the injunction in his mind. He stopped suddenly, and the lowering process commenced. In two minutes the fastening of the dead line in the block gave way, the rope was pulled through the becket, and a four ton and a half weight had a clear fall of forty-six feet. The iron struck the lower chord of the temporary bridge, and false works, men, engine, derrick, and car, in one confused mass, were submerged in seventeen feet of water. About sixty feet of the false works were involved in the destruction, and the remainder was left intact.

The amount which will be required to repair the damage to bridge works is estimated at $7,200, and the accident will delay the construction of this portion of them one month.

—The following semi-annual dividends have been declared: Erie & Pittsburgh, 1¾ per cent.; Central Ohio, 2; Chicago & Northwestern, (common and preferred) 5; Philadelphia & Reading (common and preferred) 5 per cent.

General Railroad News.

MECHANICS AND ENGINEERING.

Chesapeake & Ohio.

This great Virginia Railroad is to be completed by July, 1872. The Cincinnati *Commercial* gives the following description of the location of the line through West Virginia, which has been finally determined: "Leaving the present western terminus at the White Sulphur Springs, it follows the left side of the valley of Howard's Creek to Greenbrier river; it then passes along the left bank of the Grrenbrier one and a half miles, and crosses to the right bank; it then follows the right side for eight and a third miles, and recrosses to the left bank; it then follows the left side for about eighteen miles, and again crosses to the right bank, and continues on the right side to the junction with New River, and thence along New River to Miller's Ferry, where it crosses to the left, or south bank. From this point it continues on the south side of New River and the Kanawha to the mouth of Scary Creek; it then ascends the valley of Scary Creek, and passes through Tear's Valley to that of Mud river, and, having crossed that river twice, it enters the Valley of the Guyandotte, near the town of Barboursville. It then follows the north side of that valley to near the town of Guyandotte, where it crosses the river, and enters the valley of the Ohio, and follows it on the left side to the western terminus, at the mouth of the Big Sandy river. Construction contracts have been given out for over $4,000,000."

Extension of Woodruff's Sleeping-Car Patent.

The Acting Commissioner of Patents on the 2d inst. decided to extend the Woodruff sleeping-car patent for another term of seven years. The patentees argued that it had cost so much to introduce the patent for the first seven years that they only realized $20,000 profit therefrom.

Burning Cinders.

A newspaper item says that the Worcester & Nashua Railroad has an appliance attached to its passenger locomotives in the shape of a large pipe counecting the smoke stack with the fire box, by which means the great nuisance of flying cinders is obviated, they being all reburned.

Product of the Troy Bessemer Works.

A correspondent of the *Scientific American* gives the following figures of the product of the two five-ton Bessemer converters of John A. Griswold & Co., of Troy, for October:

No. of working days	27½
No. of days in which steel was made	26½
No. of days stopped for repairs	1
Total tons ingots	1,686½
Total No. changes made	349
Average tons of ingots per change	4.83
Average No. changes per day	13.18
Average tons of ingots per day	63.64

One of the best works in England advertises that it can make, with the six-ton converters, 150 tons per week, or say 650 tons per month. The highest product, it is believed, of a pair of five-ton converters in Europe is 750 tons per month. The remarkable product of the Troy works—1,686 tons—is due to improvements developed there, and coming into use in the other works in the country.

Rock Island Government Bridge.

The abutments on either side are finished. Piers 1 and 2, counting from the Iowa side, are finished. No. 3 wants a few days' more work; No. 4 is above water; No. 5 is coffered, and, with ordinary success in closing up a leak, will be raised to a point of safety before the ice reaches us. The pivot and the lower rest pier are finished; the upper rest pier is safely above water and is being pushed rapidly to completion.

While the pier work progresses, a force of men are putting in a crib of heavy timber between the pivot and rest piers, designed for the double purpose of protecting these piers from ice and protecting boats in their passage through the draw. The island abutment of the railroad bridge is also well advanced, and ten days more of favorable weather will put the whole work beyond the reach of ice or flood.

Some of the points in the style and construction of these piers are worthy of note: They are all set in the bed rock and securely fastened to it with iron pins; the heaviest rocks are used on the nose of the pier, and are held together by strong iron clamps. Each layer is securely pinned to the layer beneath, forming one compact piece of masonry. The piers are very long, compared with their width, thus securing a large amount of bed surface with the least resistance to the passage of the water. The slope on the upper side is very abrupt and the edge is protected by a plating of half-inch iron. firmly riveted into the rock, thus presenting the best possible means of breaking and throwing off the floating ice. The piers are set at right angles with the current, thus giving boats an easy and direct passage through the draw.

One of the most difficult, yet most beautiful pieces of masonry we have ever seen, is that on the upper rest draw-pier. It is nearly in the shape of a semi-ellipse, with the head so neatly and exactly sloped that each stone must be cut and fitted to its own particular place in the pier.

The draw portion of the bridge will be 366 feet in length, and being two stories in height, will be probably the heaviest draw to be swung open and shut in the whole country. It will give the boats 160 feet passage way, in calm, deep water, and thus will be a great improvement on the passage of the old bridge.

Col. J. N. Macomb is in general charge of all the government work on the Upper Mississippi. Major Stickney is in immediate charge of the bridge.—*Rock Island Union.*

Narrow Gauge.

The committee of the Buffalo & Springville Railroad Company, which lately made a visit of examination to the Toronto, Grey & Bruce—narrow gauge—Railroad, say in their report:

"In the road there was nothing striking beyond the facts that the rails were lighter than those in ordinary use. So with the rolling stock—it was, in general, like that to which we are accustomed, except that everything was reduced in size in proportion to the reduction in the gauge. The distance from the rail to the top of the car platforms was only thirty inches, and in place of two trucks, one at each end, there were three axles, the effect being to readily accommodate the wheels to the sharp curves. The result of this improvement in running gear is to give each car a joint in the middle, and to impart to a long train sinuous capacities. In this peculiarity, and the decrease of resistance consequent upon a diminished gauge, the superiority of this class of roads centres. The grand saving is in the cost of construction through this power of adapting narrow gauge roads to the country passed over. If a hill is in the way, instead of grading over it or boring through it, the narrow gauge road runs around it.

"The comparatively light weight of the rolling stock is a fact which, engineers say, sensibly diminishes the wear and tear. On the short route traveled over, grades as heavy as 106 feet to the mile were overcome without apparent difficulty, and curves were rounded at a good rate of speed, the sharpest of which had a radius of 470 feet. We were assured that on tracks of this width much sharper turns can be made than any existing on the Toronto, Grey & Bruce road. Several bridges were crossed on the route, one 335 feet in length, and spanning a very deep gorge. The saving in the lightness of their construction was remarked. Very great economy in bridge structure must necessarily result from the introduction of a narrow gauge for railroads.

"Your Committee are unanimous in saying that the railroad examined by us, in our judgment, possesses all the requisites in every respect desirable for the Buffalo & Springville Railroad, feeling confident that its capacity is fully adequate for present and future business wants.

"The cost of construction and equipments, with sufficient rolling stock, can be safely estimated at a sum not exceeding $14,000 per mile; and would, in the judgment of experienced men, fall considerably short of that sum, taking into account the generally feasible route through which it would be constructed, while the cost of operating the same would be proportionately less."

The Buffalo *Commercial Advertiser* describes as follows another narrow gauge road:

"An organization in Ohio, under the name of the Piqua, St. Mary's & Celina Railroad Company, has been incorporated on a capital basis of $400,000, to build between Piqua and Celina, through Miami, Shelby, Auglaize and Mercer counties, a distance of about 44 miles. Last winter the plan of a narrow-guage road was proposed and discussed, which it was estimated would cost, fully equipped, less than $500,000, in place of one of the ordinary gauge costing $1,500,000. The design is identical with that of the Welsh railways, which have been so often described in engineering journals of late.

"The plan was adopted, as the route most desirable between the points named run almost parallel with and in close proximity to the St. Mary's canal, and the divided traffic in that section would hardly warrant the construction of a broad gauge and consequently expensive road. The gauge of the proposed road is thirty inches. The right of way is to be 15 feet in place of 40 feet; 20-lb. instead of 56-lb. iron will be required; the locomotives, weighing 6 tons instead of 20, will draw from 10 to 20 loaded freight cars, each having a capacity of 2½ tons; under freight and passenger cars alike (the latter seating 20 persons), four-wheeled trucks will be placed; the ties will, of course, be nearer than on the wide gauge;—while, finally, on account of the lightness of car equipment, in comparison with capacity, and of the central position of the trucks, both higher gradients and sharper curves are practicable, greatly reducing cost of excavation and other important items of construction."

The Kansas & Missouri Bridge.

"A very severe and exceedingly satisfactory test was had on the 19th of September of the stability of the iron columns used for the substruction of the bridge, which should be recorded.

"While the submarine No. 14 was engaged taking up the anchors in the river, at a point about 100 yards above the column which has just been sunk for pier No. 1, her holdings gave way, and she drifted, with the whole force of the current, broadside, against the column. Although the timbers of the boat were seriously bruised by this heavy blow, the column was not injured, and not even moved in the least.

"This column now stands alone, and is not yet filled with masonry, and at the time of the accident had a heavy barge anchored to it. If in this unfinished condition it was not affected by one of the heaviest boats on the Missouri river striking it in the manner described, some idea of the stability of these iron piers can be formed when it is known that each pier will consist of three of these columns filled with masonry, and all firmly braced and tied together."—*Journal of the Franklin Institute.*

A Wire Rope Bridge.

At the recent meeting of the British Institution of Mechanical Engineers, Mr. William Hackney, Swansea, read a paper describing a wire rope bridge at Landore Steel Works, for conveying materials across a navigable stream. The following is a summary of the paper:

"This bridge has been erected as an inexpensive means of removing the spoil from excavations made in carrying out an extension of the Landore Siemens Steel Works, near Swansea, and depositing it on the low, marshy ground at the other side of a navigable stream which runs by the side of the works; and it was a necessary condition that any structure thrown across the stream should be arranged so as not to interfere with the passage of vessels. The bridge is constructed of a pair of steel wire ropes, stretched alongside each other across the stream, and stretching downwards from the higher bank on which the works are situated, to the lower ground on the opposite side, where the spoil is deposited. On each rope travels a runner, or small carriage mounted on a pair of grooved wheels, from which the trucks are suspended by chains; and the two runners are connected together by an endless wire cord passing round a pulley on each bank, so that the loaded truck running down from the higher bank on one of the ropes draws up an empty truck from the lower bank on other rope, the inclination of the ropes being sufficient for this purpose; the speed is regulated, if necessary, by a brake upon the cord pulley. The ropes are strained over abutments on either bank, and attached by chains to anchorages in the ground; and in order to admit of the passage of vessels in the stream, the abutment on the upper bank is constructed of a timber framing mounted on wheels, which can be run forwards to a sufficient distance to allow of the wire ropes being lowered to the bottom of the bed of the stream, so that the whole bridge is then completely out of the way of passing vessels. For raising the bridge again, the movable abutment is drawn backwards by a hand winch, until the ropes are hauled up nearly tight; the hauling chains are then hooked to the anchorages by screw couplings, by which the ropes are finally tightened up, and the hand winch is thus relieved from all strain during the working of the bridge, In this way the bridge is raised into its working position in the course of a few minutes by a couple of men at the upper end. Owing to the curve in which the wire ropes hang, their inclination is steepest close to the upper bank, thus retarding the speed of both trucks as they approach the landings on either bank, and serving generally to stop them without the use of the brake. This bridge has now been in constant use for several months, and has proved very satisfactory for the special purpose for which it was designed."

The Warsop Aero-Steam Engine.

A description of this engine is given in the following report of a paper prepared by Richard Eaton, of Nottingam, England, and read before the British Institution of Mechanical Engineers:

"The principle of this engine consists in injecting a continuous supply of heated air into the bottom of the boiler, whereby the water in the boiler is kept in a constant state of agitation throughout; and the result is

found to be that the generation of steam is rendered more rapid, with considerable economy in the fuel consumed, while incrustation in the boiler and priming are prevented. The air, compressed to the boiler pressure by an air pump driven by the engine or by a separate donkey engine, is conveyed to the boiler through a set of heating pipes fixed in the boiler flues, and is thus heated to a temperature of about 600° Fah. by heat which would otherwise escape to the chimney as waste; and it enters the boiler through a pipe extending along the entire length of the bottom of the boiler, and perforated on the under side with a series of small holes for distributing the air throughout the water in the boiler. The quantity of air injected can be varied as desired, but the proportion found most suitable generally is 12 per cent of the steam generated, the combined air and steam passing off to the engine. The plan has been tried principally with non-condensing engines at present; but the effect upon the vacuum in condensing engines is found to be a diminution of not more than 2 lb. in the vacuum otherwise obtained with steam alone. An important result of the employment of air in this manner is the entire prevention of incrustation in the boiler; and this result has been fully established by the experience of the boilers worked on this plan. Comparative trials have been made for a length of time with stationary boilers fed with water containing a large amount of deposit, and also with marine boilers; and in every instance there has been an entire freedom from incrustation, while similar boilers working under the same circumstances, but without the air injection, have become seriously incrusted with earthy or saline deposit requiring frequent cleaning out. Another important advantage found to attend the use of the air injection is the prevention of priming; so completely is this prevented, that marine boilers working at high pressure are, with the air injection, worked at a considerable higher pressure of steam, and with a consequent higher speed of the engines, than is practicable without the air injection on account of priming. The heated air injected into the boiler has moreover a direct evaporative action upon the water, equivalent to an increase of heating surface in the boiler; and this increase has an extra efficiency from the circumstance of the air being in direct contact with the water, instead of the heat being communicated through the medium of imperfectly-conducting metal plates."

OLD AND NEW ROADS.

Connecticut Western.

This road is now nearly ready for laying the track between Collinsville and Hartford. By the 1st of July, 1871, the entire road will be in running order. At this time over $1,400,000 have been expended on the road, all of which has been received from the stockholders. About $200,000 more will be received from the stockholders, and the balance necessary to finish and equip the road will be realized from a sale of its mortgage bonds.

Mt. Vernon & Grayville.

The tax-payers of Posey county, Ind., are said to be getting out of patience with the slow progress of the road and rumors of an injunction against the collection of the special railroad tax are in circulation.

Evansville & Crawfordsville.

The Rockville, Ind., *Republican* reports that the extension of this road from its present northern terminus at Rockville nurtheastward to Crawfordsville is progressing favorably. The grading is nearly completed to Waveland, on the Crawfordsville end, and work will soon begin on the Rockville end.

New Orleans, Mobile & Chattanooga.

This company is now advertising mortgage bonds for the construction of its line from New Orleans to Texas. There will be 226 miles of this road in West Louisiana and about 75 miles in Texas, the western terminus being at Houston. Such a road would need to be very badly managed not to be profitable. Sixty miles of the line in Louisiona is to be opened in January, and the Texas section within a few months. There will be $12,500 in bonds offered per mile, with interest at 8 per cent. in currency or 7 per cent. in gold, at option of the holder. These bonds will be a mortgage on the Louisiana Division.

Canada & Chicago.

A meeting was held at Tecumseh, Mich., on the 25th ult., the object being to organize a company to construct a railroad from some point on the Detroit River, in Wayne county, to some point in Hillsdale county, with a view to a shorter line to Chicago, in connection with the proposed Southern Canada Railroad line. The following gentlemen were elected directors: Ransom Gardner, Joseph B. Millard, and George Goss, of Kalamazoo; Perley Bills and Horace Brewer, of Tecumseh; Elliot T. Slocum, of Trenton; George A. Smith, of Addison; Horace R. Gardner and Witter J. Baxter, of Jonesville. W. J. Baxter was elected Treasurer; Lucius Lilly, Assistant Treasurer, and George C. Monroe, Alexander Beach, Elliot T. Slocum, J. J. Adam, Orrin B. Bowen, Commissioners. Articles of association were presented, and subscriptions were immediately taken to the amount of $80,000, and five per cent. paid in. The name of the road in the articles is "The Canada & Chicago Railway." The articles of association, and all the papers necessary to perfect the organization, were completed, and ordered immediately filed with the Secretary of State.

Chicago to St. Paul.

The St. Paul *Press* gives as follows the distances by the new route which the Chicago & Northwestern Company is constructing between St. Paul and Chigago:

	Miles.
St. Paul to Winona	101
Winona to Cut-Off	27
Cut-Off to Madison	127
Madison to Chicago	138
Total	393

Central of Iowa.

On the 3d inst. the track on the northern section of this road was completed into Grinnell, where it will cross the Chicago, Rock Island & Pacific Railroad. The line is now complete from Grinnell to St. Paul, the Central of Iowa owning that part of it south of Mason City, and the Milwaukee & St. Paul all north of it. There is also a considerable section completed from Oskaloosa southward, and it is expected to complete the line to a connection with the North Missouri this month.

Detroit, Howell & Lansing.

A telegram from Detroit dated the 1st inst. says that "Measures have at last been taken to secure the completion of the Detroit & Howell Railroad, which the Supreme Court decision flattened very thoroughly at first. The directors have transferred seven-eighths of the stock to W. B. Wesson, T. T. Lyon, and C. McPherson, as trustees for the benefit of James F. Joy, who agrees to complete and put in running order the road from here to Howell by September 1 next, and to Lansing the following Jmne. There can be but little doubt that consolidation with the Lansing & Ionia road will follow, and the further extension will be made to tap the Grand Rapids & Indiana line.

European & North American.

Work on this road is advancing and but three or four cuts will be left for the winter's operations. The principal contractor says that they shall begin to lay the track on the section between Mattawamkeag and Kingman, about ten miles, in April next, allowing a 4th of July excursion to that town. Track laying will also begin at that time on the section between the St. Croix and the Houlton & Calais road, about twenty-one miles.

Boston, Concord & White Mountains.

The extension of this road from Whitefield to Lancaster, New Hampshire, was completed and the event celebrated on the 1st inst. by an excursion from Plymouth to Lancaster.

New Bedford & Taunton.

It is said that this company will petition the next legislature of Massachusetts for liberty to extend its road from the present terminus in New Bedford to a point on tide water south of the bridge, and to increase its capital stock $300,000.

Maine Central.

It is reported that notwithstanding the decision of the railroad commissioners in the matter arising out of the contract for a lease, entered into between the Belfast & Moosehead Railroad Company and the Maine Central Railroad Company, and which relates to the construction of the former road, that it will not be accepted by the Maine Central in its present condition, the lessees maintaining that the road has not been built in accordance with the contract. The Belfast people are considerably excited over the matter, and for the present the enterprise will remain on their hands. In the event that the differences between the two roads are not adjusted, the Belfast people threaten a rival enterprise to the Maine Central.

Quincy, Missouri & Pacific.

According to the St. Louis *Journal of Commerce*, this road will be 250 miles long—commencing on the Mississippi opposite Quincy, and passing through the counties of Marion, Lewis, Knox, Adair, Sullivan, Grundy, Harrison, Nodaway, and Atchison, terminating at the city of Brownsville, Nebraska, where it connects with the Brownsville, Fort Kearney & Pacific Railroad. Ten consecutive miles are now graded and ready for the iron; thirty-seven miles are under contract and will be completed in the course of two months. On the west and between Brownsville and Phelps, Mo., an additional three miles are completed and will be in running order by January next. The object of the completion of only three miles at so early a date, is to afford a connection by rail between these two places this winter as the roads are impassable by wagon during the winter months.

Portland to Chicago.

The Rutland (Vt.) *Courier*, speaking of the new Canada Air Line, says:

"This line can be made a part of the proposed line from Portland to Rutland, Fort Ann, Oswego and Chicago, if thought best. Arrangements are now being made to form a consolidated line from Portland to Oswego, the present corporations keeping up their organizations until the road is completed, and each corporation is to elect one director for the consolidated line. New York will have three directors, Vermont two, New Hampshire two, and Maine two. A meeting of those directors will be held in Portland at 10 o'clock on the 15th of December next, to consummate the organization of the consolidated company, as well as to perfect the surveys of the route.

"Since the death of Governor Washburn, there have been but eight directors of the Rutland & Woodstock Railroad, all of whom met at the Bardwell House in this place on Monday evening last, and after an examination of documents laid before the meeting, voted unanimously to grant a perpetual lease of said Rutland & Woodstock Railroad Company's chartered rights to the proposed consolidated railroad company lately chartered by the Legislature of Maine; and also voted that John Cain, of Rutland, be made a director in said consolidated road."

North & South Alabama.

This road has been opened from Montgomery northwestward to Calera, 63 miles. A section is also in operation from Decatur southward. This will form the shortest connection between the North and Northern and Central Alabama.

Alabama & Chattanooga.

The northern division of this road is now in operation from Chattanooga southwestward to Green Pond, 169 miles. At the other end the road has been open for some time from Meridian northeastward 67 miles to the Black Warrior River. It is to be opened from Chattanooga through to Meridian, very soon. J. B. Weaver is Superintendent of the Northern Division and H. F. Wheeler of the Southern.

Pittsburgh Railroad & Coal Company.

We learn that this company is extending its road, now running from East St. Louis, about six miles east, to Pittsburgh, on the bluffs, to a point thirty miles further into the coal section of St. Clair and other counties of Illinois.

Burlington & Missouri River.

The Plattsmouth, Neb. *Herald*, says that at that place the company has commenced to lay a track from the transfer landing, down stream, about on a level with high water mark, for the purpose of bringing down trains loaded with rock for the rip-raps work. They have a quarter of a mile of track already laid, and are bringing in about seventy car loads of rock a day, which will be kept up all winter. They have a fine quarry opened about seven miles up the road, where they can get rock enough to fence up the Missouri river. Before the high waters next spring the bank will be protected for a half mile in length with a solid wall of rock as high as high water mark.

In a letter written by Mr. A. S. Belt, Solicitor of the company, he says: "Judge Greene has bought and paid for 3,600 tons of iron in the New York market since the war in Europe broke out, and by the 15th day of December next the entire line from Burlington to Cedar Falls—a distance of 163 miles—will be completed. In addition, everything about the road is first-class—road-bed, iron and rolling stock. The running time now between Waterloo and Cedar Rapids is twenty miles an hour, including stoppages, which is unprecedented time to make on a new road."

Atlantic & Pacific.

Regular trains commenced running last Monday to Neosho, Newton county, 315 miles from St. Louis. The company expects to have the road completed to the State line, sixteen miles beyond Neosho, early next month. The connections by stage line through the Indian Territory, and into Texas, are to be maintained and rendered as complete and satisfactory as possible in every respect.

The St. Louis *Journal of Commerce* says the company are making efforts to secure the right of way for their eastern extension through St. Louis county, from the city to Franklin. Three proposed lines have been surveyed, beside one leading through Jefferson county to Calva station, six miles west of Franklin, with a branch running to Carondelet for the delivery of iron.

Central of New Jersey.

Again there is a report current that the Pennsylvania Railroad Company has leased the Central of New Jersey, and thus secured an independent connection into New York. It was not long ago that it was said that it had captured the Camden & Amboy, and such reports are so common that very little faith can be placed in them.

Iowa Southwestern.

Colonel Milo Smith told the people of Oskaloosa, at an Iowa Southwestern Railroad meeting, the other day, that the Chicago, Burlington & Quincy Company would take hold of the road and construct it, just as soon as the people along the line vote or raise the amounts required. That corporation, he said, "is now building a road from Mendota, on their main line, to Prophetstown, twenty miles from Clinton, and have agreed, if we vote the aid, to finish it to Clinton within forty days after they are notified of the fact, and to put on a force, just as soon as the frost is out of the ground, sufficient to finish it all and have the road running to Oskaloosa in 1871."

Baltimore, Pittsburgh & Chicago.

At a meeting held on the first inst., at Albion, Noble county, Ind., an organization was effected under the name of the Baltimore, Pittsburgh & Chicago Railroad Company, for the purpose of constructing a road from the east line of Indiana to the east line of Illinois. Articles of association were formed, naming the following points: Commencing at a point where a line from Defiance, Ohio, to Auburn, Ind., crosses the Indiana State line; thence west through the towns of Albion, Syracuse, and Westville, to the west line of Indiana, at some point on the west line of Town 37, Range 9 west, in the county of Lake. William M. Clapp, of Albion, were chosen President of the company, and S. E. Alvord, of the same place, Secretary.

Winona & St. Peter.

The St. Peter (Minn.) *Tribune* of Nov. 30 says: "Work on the Winona & St. Peter Railroad is progressing vigorously. The grading on this side of the river was nearly completed on Saturday. The grading of the road west is to be continued, and the heavy work through the bluffs pushed forward this winter. The surveying party of the road returned yesterday from the upper end of this county, having run a line north of Swan Lake, striking the Minnesota River about four miles below Fort Ridgley, at which point the best crossing was found."

Chicago, Pekin & Southwestern.

A special session of the Board of Supervisors of Tazewell county, Ill., was held on Wednesday of last week, for the purpose, mainly, of passing upon the question of issuing the remaining $25,000 of county bonds subscribed to the Chicago, Pekin & Southwestern Railroad. A motion to issue the bonds was voted down by a vote of 13 to 3.

Keokuk & Minnesota.

The boards of the directors of the Keokuk & Minnesota and Iowa Northern railroads, met at Mt. Pleasant on the 6th instant, and effected a consolidation of the two companies. Geo. J. Boal, of Iowa City, was elected President, and Colonel Patterson, of Keokuk, Vice-President.

St. Louis to St. Paul.

The distance by the new route soon to be opened by the North Missouri, Central of Iowa, and Milwaukee & St. Paul roads will be 582 miles, through St. Charles, Moberly and Macon, Mo., Albia, Eddyville, Oskaloosa, Grinnell, Marshalltown, Eldora, Hampton and Mason City, Iowa, and Austin, Owatonna, Faribault and Farmington, Minn.

Des Moines Valley Railroad.

The survey of the extension of this road has been completed to the north line of Iowa, which it intersects on the west side of Eagle Lake, near the town of Estherville, in Emmet county.

Des Moines & Sioux City.

There is a report in Des Moines that the Chicago Rock Island & Pacific Railroad Company will construct a branch next season, or as soon thereafter as practicable, from a point about 25 miles west of Des Moines northwestward to Sioux City, a distance of about 150 miles. There is room enough for such a road, but for nearly half its length it would cross at right angles the ridges and bluffs of Western Iowa.

Chicago & Southwestern.

The directors of the company which proposes to construct a branch of this road from Centreville near the south line of Iowa to the Missouri River held a meeting at Hamburg, Fremont county, Iowa, last week, and a great number of people of that county assembled to meet them, delegates from Taylor and Ringgold counties being present also. Hamburg pledged $20,000, a tax of 5 per cent., and right of way, Brownville, $100,000 and other advantages, Taylor county, $100,000, with right of way, and Ringgold county $50,000, with right of way. Judge Aller, President of the company, told the people that the company was backed by the Chicago, Rock Island & Pacific and the Pennsylvania Central companies; that they meant business; that they wanted to know just what the people along the line would do; and that they would not ask for a cent of money until the road should be completed.

Winterset & Des Moines.

The Winterset (Iowa) *Madisonian* says that there is a fair prospect that a road will be built from that place (which is 24 miles due south of De Soto station on the Chicago, Rock Island & Pacific Railroad) east by north down Middle River to a junction with the New Des Moines & Indianola Railroad at Summerset, six miles north of Indianola and about fifteen miles from Des Moines. It would form a branch of the Rock Island road, which, it is said, will iron and stock the road as the road bed is prepared. It would be 28 miles long.

Missouri, Iowa & Nebraska.

This road is to run from Alexandria, Missouri, opposite Warsaw, in Illinois, northwest into Iowa and thence, through the southern tier of counties in Iowa, to Nebraska City. Twenty-five miles of grading from Alexandria northwestward is finished and tracklaying was to commence this week. The Iowa Railroad Contracting Company, composed of Benjamin E. Smith, Chas. J. Perry, Andrew Carnegie, D. W. Kilbourne, Wm. Leighton, J. Edgar Thomson, Thomas A. Scott, Henry Hill and C. A. Sicor, has contracted to iron the road, and the first installment for that purpose has already been shipped.

Iowa Midland and Davenport & St. Paul.

A correspondent writes to us that the Iowa Midland Railroad was completed to the junction of the Davenport & St. Paul Railroad last Saturday, and that arrangements have been made with that company by which both roads will for the present, use the same track from the junction to Maquoketa, a distance of seven miles. On this part of the road the track is all laid, and both roads will be open for business next Tuesday. Our correspondent says: "The Midland is a good, honest well built road, and runs through a splendid agricultural country."

Cheyenne, Iron Mountain & Pacific.

Articles of incorporation have been filed with the Secretary of Wyoming Territory incorporating a company with this name, which proposes to construct a railroad from Cheyenne and connect with the Helena, Big Horn & Cheyenne Railroad at the northern boundary of Wyoming. General Silas Reed, Surveyor General, was elected President; Governor J. A. Campbell, Vice President. There is plenty of room for the road, but at present there is no business for it to do.

Missouri, Kansas & Texas.

A correspondent at Salem writes that the Northeastern extension is progressing favorably. Between Sedalia and Favette, forty-eight miles, the grading and masonry are rapidly approaching completion. Beyond Fayette, in the direction of Quincy, large subscriptions are being made, and as the work in that direction is comparatively light it can soon be made ready for the iron throughout its entire length. Surveys have been made at Boonville for a bridge over the Missouri, and it has been ascertained that the location is equal to any on the river for that purpose.

The distance from Sedalia to Hannibal will be about 130 miles, if a connection is made at Moberly with the Hannibal & Central Missouri Railroad. If the line be run through Renick to Paris the distance will be reduced several miles. This is by many miles the shortest line now building between Chicago and the "cattle country," and, in all probability, the shortest that ever will be built across Missouri, making but 314 miles from Hannibal to Chetopa, Kansas, and mot more than 324 miles from Quincy to Chetopa. In the line from Hannibal to Chetopa, there are, between Sedalia and Chetopa, 184 miles which will be completed and equipped by January, 1871; 108 miles from Sedalia to Fayette and from Moberly to Hannibal, which are nearly ready for the iron, leaving only 22 miles—Fayette to Moberly—to be provided for.

The telegraph informs us that the Sedalia and Fort Scott Line which originally was known as the Tebo & Neosho Railroad—was completed into Fort Scott on Monday last and that trains began to run regularly on it last Wednesday. It is to be extended still further southwest to a connection with the Neosho Valley Division.

Hastings Bridge.

The American Bridge Company of this city has the contract for constructing the iron bridge over the Mississippi at Hastings for the St. Paul & Chicago Railroad.

ELECTIONS AND APPOINTMENTS.

—The directors of the Pekin, Lincoln & Decatur Railroad Company held a meeting at Lincoln, Ill., on the 23d ult. and ratified the lease of the road to the Toledo, Wabash & Western Company, D. C. Smith, of Pekin, was elected Director and Treasurer in place of Ties Smith, deceased. O. R. Cobleigh, of Pekin, was elected Superintendent. The road is now completed from Pekin to Delevan, and a daily accommodation train is running over the same.

—B. F. Newcomber, of Baltimore, has been elected Vice-President of the Wilmington & Weldon Railroad Company, and of the Wilmington, Columbia & Augusta Railroad Company.

—The Richmond & Petersburg Railroad Company have abolished the office of superintendent, and elected the late Superintendent, Thos. H. Wynne, President.

—Alfred White, who has been for some time General Freight Agent of the Detroit & Milwaukee Railroad, is now made General Passenger Agent also.

—The President having appointed General G. M. Dodge, of Iowa, Clark Waggoner, of Ohio, and R. J. McElhany, of Missouri, Commissioners of the Atlantic & Pacific Railroad, instructions have been forwarded to them by the Secretary of the Interior to examine and report on the third section of twenty-five miles of road and telegraph line of that company.

—The stockholders of the Ocmulgee & North Georgia Railroad Company met at Macon on the 28th ult. and elected directors of the company, and the company was at once organized by the election of Wm. K. deGraffenried, President; Dr. E. L. Strohecker, Secretary and Treasurer; Virgil Powers, Chief Engineer. The work of laying out the route of the road is to be commenced at once.

—Mr. A. Anderson, General Superintendent, has issued the following circular:

"Mr. T. F. Oakes is appointed General Freight Agent of the Kansas Pacific Railway.

"His office will be at Kansas 'City Missouri, where all communications concerning freight should be addressed.

"Mr. R. B. Gemmel continues as General Ticket Agent, with office at Lawrence, Kansas."

—Samuel C. Hough, who was for a long time General Western Passenger Agent of the Michigan Southern Railroad, with headquarters in Chicago, has been appointed General Passenger Agent of the Lehigh & Susquehanna Railroad, with office in Philadelphia. Ticket reports etc. will be sent as heretofore to J. A. Dinkey, the General Ticket Agent, whose office is at Mauch Chunk, Pa.

—A. Shaw, formerly passenger agent of the Selma, Rome & Dalton Railroad, has been appointed Assistant Superintendent of the North & South Alabama Railroad, lately opened from Montgomery to Calera.

—The new officers of the Selma, Rome & Dalton Railroad are John Tucker, of Philadelphia, President, and D. S. Prentiss, of Rome, Ga., Vice-President.

—Under the new management the following are the officers of the New Orleans, Jackson & Great Northern Railroad: H. S. McComb, President, Wilmington, Del.; R. S. Charles, Secretary and Treasurer; E. Q. Sewall, General Superintendent; A. Brown, General Freight Agent; J. B. Morey, General Ticket Agent, New Orleans. The officers of the Missisippi Central, which forms the northern connection of the above road, are H. S. McComb, President, Wilmington, Del.; J. B. Alexander, Vice-President, New York; J. Y. King, Treasurer, New York; S. H. Edgar, Secretary, Wilmington, Del.; E. D. Frost, General Superintendent, A. J. McConnico, Auditor, D. B. Morey, General Freight and Ticket Agent, Water Valley, Miss.

—Mr. Lafayette Devenny, for two years past General Freight Agent of the Cincinnati, Hamilton & Dayton Railroad, has retired, in accordance with a determination expressed at the annual election last May, when he only consented to serve until a successor could be selected. On the 1st instant Mr. J. R. Reed succeeded Mr. Devenny, by appointment. Mr. Reed occupied the same position for eight or ten years, before Mr. Devenny's appointment.

—We hear that among Stock Exchange gentlemen the Grand Trunk has been nick-named the *D—n Trunk*.

Very pretty language, gentlemen, but we are not much surprised at your being quite out of humor with a concern which yields so little to its proprietors, and whose last half-yearly report was so blank; permit us, however, to say that we can remember the time when the Dutch Rhenish was called the *Dutch Rubbish*, and yet now-a-days where is there a better railway property than that same "Dutch Rubbish?"—*Herapath's Journal*.

RAILROAD GAZETTE

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent

Change in Rates.—On and after the 1st of January next, the price of subscription will be four dollars per year. Until that time, subscriptions will be received for periods not exceeding one year at the old rate—three dollars per year.

☞ *Our Prospectus and Business Notices will be found on the last page.*

PUMPS VERSUS INJECTORS.

In building or ordering locomotives, the question nearly always arises, and must be decided, whether they shall have pumps or injectors, or both, or how many of each, for feeding the boilers. When Giffard's injector was first brought into use in this country, it was confidently recommended as a substitute for pumps in locomotives, and many engines were built without any other provision for feeding the boiler. A practical difficulty was, however, at once experienced, from the fact that injectors required more or less skillful manipulation in order to make them work. Whenever, therefore, an engine without any pumps was put in charge of a man unskilled in the use of the injector, there was great danger that the boiler would have at times an insufficient supply of water. Besides, even with the most skillful handling, it was found that the injectors which were first made could not be depended upon for the rough work to which they were necessarily exposed in locomotives. At the most critical times they would stop, or refuse to work, and their liability thus to fail soon made engine runners afraid of locomotives without pumps. Doubtless the reputation of injectors suffered more than it should, from the fact that many locomotives were supplied with only one. This practice was even more dangerous than to put only one pump on an engine, as injectors are even more liable to disorders, and what sometimes seem like freaks, than pumps are. No locomotive runner would feel safe with only one pump on his engine, and of course with a new apparatus like an injector, the construction of which he was frequently ignorant of, and whose operation seemed mysterious, and even contradictory to natural laws, he always felt apprehensive, and with good cause, too.

The difficulties which attended the use of only one of them soon led master mechanics to supply engines either with two or else with one and a pump. With the latter arrangement, however, it soon appeared that runners found it more convenient to use a pump than an injector for ordinary work. Improvements have gradually been made in injectors, so that the latest are more reliable than some of the earlier ones; but with the best of them, some little manipulation is necessary to start them and considerable skill required in order to have them always go to work with certainty. A pump can be put at work with a single movement of a lever, and its rate of feed regulated by the distance the index is moved. Besides, the amount of water a pump will force into the boiler is dependent to a very great extent on the speed of the engine. In running fast, it of course makes more strokes than in running slow; and when the engine stops, the pump stops, so that the amount of water thus supplied to the boiler is regulated by the amount of work done by the locomotive. An injector, on the contrary, works the same at all times. Whether the locomotive is running fast or slow or standing still, it throws a uniform stream into the boiler. It is also a much more delicate instrument than a pump, and, as stated above, its manner and course of operation is not so easily understood by the popular mind. It has several very delicate valves and apertures which are easily clogged with mud or dirt of any kind, so that an injector to be kept in perfect working order requires to be frequently used and taken apart and cleaned. This of course is the duty of every good engineer, and should always be done, but it must be remembered that engineers like the rest of us are human and prone to leave undone the things which they should do.

Persons who have no experience in running locomotives, have no idea of the anxiety to which runners are often subjected by the failure of their means of feeding the boiler with water. Imagine yourself, reader, in charge of a locomotive with a train of from thirty to forty cars, which it will tax your engine to the utmost to take up the grade. By long experience you have learned perhaps just how much steam the boiler will make, how much adhesion the driving wheels will have to the rail, and you know that unless you fire very carefully the lungs of your machine will be exhausted, or if handled without caution it will loose its foot-hold. Therefore on the long level stretch of track, or the descending incline approaching the up grade, you fill the boiler with as much water as you can carry, and get it as hot as possible without blowing off, so as not to be obliged to pump much cold water into the boiler while going up the hill, In other words, you heat up a boiler full of water on that part of the road where you can make more steam than you need, to be used where you know you cannot make enough. You have calculated this matter closely, you know just about how much you can feed the boiler on the grade and hold your steam, and how low you can work the water by the time you reach the top of the hill without danger. The forces are nicely balanced. A failure of any one of them means that you will "stick fast," and either be helped up by another engine or leave part of the train on the main line while you take the other part to a side track. Imagine, now, that you have barely time to get up to get out of the way of, say, the Pacific express in front of you and the mail train behind. The boiler has not steamed well, and in order to pull the train you have worked down the water to a point so low that if the supply should fail it will become dangerous. You watch the steam and water gauges anxiously, and the exhaust discharges are counted by the beat of your pulse. You try the pet cock every minute, which somehow grows feebler in its discharge, while the water in the glass gauge goes slowly lower and lower. You know only too well that if the throttle is closed the water will go clean out of sight. Suddenly the pump stops working. The Pacific express is in front, the mail train following. To go to the top of the hill without more water would be suicidal. You try the injector in a perfect frenzy of excitement, and find it will not start. The steam gauge starts upward and with every beat of the exhaust your engine fairly shivers with her work. The boiler grows hotter and hotter. You screw the injector first one way and then another, and it hisses and foams and gurgles, but never a drop will it start into the boiler. Remember, the Pacific express is in front, the mail train following. You see the conductor examining his watch by the light of his lantern. Your pet cock shows the pump is not working. To stop would be to stick fast irretrievably. To go on is to face dismissal, danger and even death; and all the while the Pacific express is howling through hill and valley towards you in front, and the mail spinning over bridges and embankments to make the side track in front of you before the arrival of the express. As the safety valve goes off with a sharp report you think you would give your coat, your hat and your boots for another pump.

It is true that there are occasions of which a similar picture might be drawn when a runner is brought to the same desperate straits for the want of an injector. An engine in a snow drift, or hemmed in on a side track by other trains, or in any other position where it is impossible to pump up is often sorely tried to get water into the boiler. In such cases an injector is a very great advantage. It can than be handled leisurely. It can be coaxed and humored, and cooled with cold water if it is hot, or warmed if it is frozen and tried first one way and then another until it is induced to start.

As an auxiliary, an injector is almost as useful as a pump itself; but as a substitute, it is inadequate and unreliable for doiug the work. The manifold duties of a locomotive runner in the critical moments of going up a heavy grade, will not allow him the time which is often necessary to manipulate the delicate parts of an injector, nor can he relax his keen watchfulness while running a "fast" train and give his attention to starting the water, even though only a few seconds are required to do it.

To put two pumps *and* an injector on locomotives is at any rate in accordance with the maxim of business, not to take any unnecessary risks. Of course a reasonable discretion should be exercised in regard to the amount of security which the exigencies of running locomotives require; but we believe we are not misstating the experience of nine out of ten runners, when we say that fully that number will very much prefer a locomotive with two pumps rather than one. We do not at the present time know of any engines running in this country with injectors alone.

The objections to using injectors on locomotives which we have stated of course do not apply to their use on statonary boilers. Time for manipulating them is not so important an element in the quiet of an engine room as it is on a locomotive. The jar to which they are subject in the latter service, often prevents their working regularly. On stationary engines they of course are not affected by that cause.

THE CHICAGO & NORTHWESTERN DIVIDEND.

The announcement that the Chicago & Northwestern company would make a 5 per cent. cash dividend for the first six months of the current year has been received with surprise by some financiers in New York, and some at least of these (doubtless all who were "bearing" Northwestern stock), are disappointed and disgusted by the announcement.

The New York *Commercial Advertiser*, in commenting on the surplus from which this dividend is to be made, insinuates that the proceeds of $800,000 in bonds issued to secure the construction of the LaCrosse, Trempealeau & Prescott Railroad (popularly known as the "Winona Eastern Connection"), have not been applied to that purpose and may have gone into the surplus fund.

A thorough discussion of this subject appears in the New York *Bulletin*, a daily commercial and financial journal, whose statements, evidently, are made by authority and from the company's books. From this it appears that the Northwestern Company have advanced not only the proceeds of $800,000 in bonds, but $186,000 in addition to the "Eastern Connection, and that it has issued $313,000 more to the Winona & St. Peter Company than the $800,000 of bonds issued by it. Thus it appears that the company has made temporary advances of $499,000 which otherwise might have been added to the surplus fund. The *Bulletin* gives the following:

Statement of advances made by the Chicago & Northwestern Railway Company for construction and equipment of the Winona & St. Peter Railroad up to October 31, 1870.

Amount advanced for extension of the road from Waseca to Saint Paul and Mankato	$1,069,558 36
Less amount received for sale of W. & St. Peter R. R. Co.'s bonds	756,281 88
Balance due C. & N. W. R. W. Co., Oct 31, 1870	$313,276 48
Amount advanced by Chicago & Northwestern Railway Co for the La Crosse, Trempealeau & Prescott R. R. Co. up to Oct. 31, 1870	$1,025,232 65
Less amount received for sale of L. C. T. & P. R. R. Co.'s bonds, and for interest	839,325 16
Balance due C. & N. W. R. W. Co. Oct. 31, 1870	$185,907 49

RECAPITULATION.

Balance due on construction advances:	
From Winona & St. Peter R. R. Co	$313,276 48
From La Crosse, T. & Prescott R. R. Co	185,907 49
Balance due C. & N. W. R. R. Co. Oct. 31, 1870	$499,183 97

The "Eastern Connection," as we have said heretofore, is now nearly completed, and would have been entirely so but for delays in receiving iron. The only expense to be incurred now, we believe, is for the laying of seven miles of track, the road bed being completed.

A party hostile to the present administration has issued a circular in New York which asserts that the capital of the company is $10,000,000 greater than in 1867, and that the earnings, estimated on the basis of the September traffic, will be $2,100,000 less for the current year than for that year. This is not a very ingenuous statement. It is true that the earnings were considerably greater in September 1867 than in September 1870, but it is also true that the average earnings for the part of the year which has expired are greater than they were for the same months in 1867. By the figures which the *Bulletin* gives the increase in capital has been but little more than six millions, instead of ten millions as stated in the circular. The increase is accounted for by a transfer of the debts of the Beloit & Madison and Chicago & Milwaukee companies, amounting to $2,097,300, to the Northwestern books, and by the stock dividends declared under Mr. Keep's administration, "by which," says the *Bulletin*, "the party now decrying the road were largely benefited."

Here in Chicago and on the line of the road it is easy enough to see how the net earnings may have increased while the gross receipts have decreased. The most rigid economy has been enforced; the road has been operated with the smallest force possible, consistent with safety; salaries of officials have been cut down, and a reduction of expenses effected wherever it was possible, as shown in detail by a statement of expenses which we reproduce from the New York *Bulletin* in another column.

There can be no doubt that the condition of this property with reference to its connections has been materially improved since Mr. Tracy's election. The much needed St. Paul connection, which will give it an independent connection with Minnesota by the shortest route and an opportunity to share largely in the carrying of materials for the Northern Pacific, and at the same time give an outlet to the company's Winona & St. Peter line, is well advanced and sure to be completed at an early date. Other connections of importance have been secured, and for the first time in its existence there is a prospect that its lines will in a few months form a complete and independent system.

The Railroad Conference.

There have been several meetings of the managers of the trunk lines from New York westward, at which, we are informed, there was reasonable harmony and a disposition to compromise on disputed points. The result so far has been the advance in passenger rates, the new time tables, and the advance in freight rates westward. The passenger rates have been made about 25 per cent. higher to Chicago but 12 per cent. lower than they were last year. The freight rates are advanced to just about the usual winter rates.

It is understood that the chief object at the recent meetings has been to agree upon some plan for working harmoniously, the discontinuance of all efforts to solicit business and the expenses therein involved, and a division of the receipts among the several lines according to some definite system. There can be no question that such an arrangement would prove economical, but there are very many details to be adjusted, and perfect faith required; and if the arrangement should not be permanent some of the parties would probably suffer heavy expenses for the renewal of competition.

The Green Bay Line of the Chicago & Northwestern.

The Portage Lake *Mining Gazette* complains that the managers of this road have neglected its interests, as well as those of the Lake Superior Company, by not completing the connection of their lines between Green Bay and Escanaba. It says that it would not cost more than $2,200,000 to build this link of 110 miles, and that the grant of land would more than repay the cost.

We presume that the company has postponed the construction of this section for the same reason that the towns of Marquette and Portage have not undertaken it—because it had not money enough beyond what it needed for more promising or more pressing purposes. The Northwestern is now engaged—at least interested—in the construction of not less than 300, and we think we may say 450, miles of railroad, which is a pretty large undertaking even for so great a company. There is probably no section of the lines now under construction which is not likely to be more profitable and serve more people than the Green Bay road. But the Lake Superior people may say this ought they to have done, and not left the other undone. Here it is taken for granted that a great railroad company can not only do anything but everything. This is a mistake which we beg leave to correct. Rich men and great corporations have the same limitations in their business that individuals have in theirs.

To construct *and equip* the Green Bay line would cost nearer $4,400,000 than half that sum. The average amount of capital represented by a mile of the Northwestern's road at present is more than $40,000. But whatever be the cost of this line, it would not have been easy to undertake it just when the company was was engaged in other lines equal to one-third of its present mileage. The road, doubtless, would be a great convenience to a considerable number of people; but it is not at all fair to estimate its probable business by the business of the line terminating at Escanaba. By far the largest part of the business of that road is an ore traffic, very little of which would, in any event, go further south than Escanaba. The travel and merchandise traffic is very light and can hardly be otherwise until the Upper Peninsula is more populous. However, we doubt not that the road will be constructed eventually, when the Northwestern has a little less on its hands.

The General Ticket Agents' Association.

Mr. Samuel Powell, the Secretary of this association, notifies members that a special meeting will be held in the Kennard House, Cleveland, on Tuesday, the 13th instant, at 11 o'clock a. m., for the purpose of adjusting rates and divisions. Members are especially requested to come prepared to state clearly and definitely the changes which they may consider it proper to make in the local or intermediate rates of their several lines.

This meeting is made necessary by reason of the recent considerable changes in through fares.

Among the Railroad Shops.

CHICAGO, ROCK ISLAND & PACIFIC—CHICAGO SHOPS.

So much has been said about the uniformity of rolling stock, that any reference to it begins to sound very much like an old sermon which we have heard often, but whose precepts we have not practiced. The subject has, however, been recalled to our minds very forcibly during recent visits to different railroad shops. At nearly all of them new engines are being built, which are so similar to each other that it seems as though any skillful person could, by a very little compromise, make them alike both in their proportions and design. With the exception of some four-wheeled switching locomotives, all that we have seen are eight-wheeled engines, of the usual American plan, *i. e.*, with four driving wheels and a truck. The boiler frames, valve gearing, and nearly all the other parts are of the same general plan. The differences between them are nearly all attributable either to personal fancy, or are matters of accident. It is true that apparently good reasons are given for making some things one way rather than another; but where this is the case, a little patient, intelligent and unprejudiced investigation would, we think, usually discover which is the best, and thus establish uniformity. There is a propensity in the human mind *not* to do what any one else has done, just as there is a counter and more common impulse to follow blindly what others practice; but, giving full weight to both these tendencies, it seems as though the time had come for railroad companies, by some joint action, to establish some sort of common system and uniformity in the rolling stock they have built. Just how this could be brought about is not easy to say. The Master Mechanic's Association has been coquetting with this question, but their association is lacking in two at least of the important requisites for the accomplishment of this task, *viz.*, time for investigation and authority to enforce their recommendation. Ordinary American locomotives are now all so nearly alike, in both proportion and design, that we think it would be comparatively easy for an experienced person, with a little care, to make a plan which in all its details would substantially fulfil the conditions required by each builder. A comparison of the following specifications of locomotives which Mr. Twombley the Master Mechanic of the Rock Island road is now building, with those we have discussed in previous numbers built in their shops, will show that no important difference exists between the practice of each. Mr. Twombley has just finished one new engine, another is nearly complete, and work has been commenced on two more. All will be built to the following specifications:

SPECIFICATIONS FOR COAL BURNING LOCOMOTIVES.

"Fire-box to be 5-16 in. homogeneous steel; flue sheet ⅜ in.; crown sheet to be securely stayed with crown bars, double, 4¾x⅝, welded at both ends, resting on crown sheets and side sheets. Washers 1 in. thick between crown sheet, with ⅝ in. bolts tapped through crown sheet and nutted on bottom of crown sheet. Back flue sheet to run from crown sheet to bottom ring without a seam. Bottom ring same width as water-space and 2½ in. thick. Bottom of fire-box to be 19 in. above top of rail. Ash pan 12 in. deep. Outer shell of fire-box to be ⅝ in. thick, of best quality of Low Moor or Sligo iron, and to be raised 8 in. above waist of boiler. Dome sheet to be flanged into dome and double riveted. Dome 24 in. in diameter, and 26 in. high. Dome and dome sheet to be strongly stayed to crown bars. There must be four oval-shaped hand-hole plates, 2¼x4 in., placed in the legs of the fire-box, two in front and two back, so as to be convenient for washing out. Outside length of fire-box 68 in. Shell or waist of boiler to be made in three courses, of the best ⅝ in. Sligo iron. All longitudinal seams double riveted in each course. Front flue sheet to be made of ⅝ in. Low Moor iron or of steel, with an oval-shaped hand-hole 2½x4 in. in bottom under flues. Space between flue holes in sheet ⅝ in. Flues of lap-welded iron 1¾ in. outside diameter, and about 11 ft. 8 in. long. Engines to have balanced throttle valves.

"Boilers to be lagged with pine wood and covered with Russia iron and banded with brass bands.

"Frames to be made in two pieces bolted together in front of forward pedestal, and to be 3⅝ in. wide through their whole length, and 3¼ in. deep in front and ⅝ in. back of front axle. All frame braces to be welded to pedestals. The jaws to be made tapered and to have wedges with flanges fitted to each side. Forward wedge in each pedestal to be stationary, reaching from frame brace to top of pedestal. Back wedges in each pedestal to be adjusted by 1 in. bolts, screwed through base and secured with jam nut on bottom. Head of bolt to be fitted into wedge. Frames to be fastened to fire-box by two wrought-iron buckles on each side ⅝ in. by 12 in. wide, extending 7 in. above and 7 in. below. Frame buckles to be bolted upon fire-box with ⅝ in. studs tapped through outer shell of fire-box, and an extra ⅝ in. plate that must be riveted upon the inside of outer shell of fire-box to give strength and bearing to studs. All studs and bolts to be made of Ulster or Low Moor iron. Bottom braces between pedestals to be fastened to fire-box in the same manner as the top of frames, so as not to prevent the expansion and contraction of the boiler. To have two braces made of 1¾ in. round iron fitted on boiler-head and back end of frames at an angle of about 45°, so as not to be injured by the expansion of the boiler. The forward end of frames to be fastened to the smoke arch with the same kind of braces.

"Cylinders to be 16 in. in diameter by 24 in. stroke. Cylinder packing to have two rings in each piston 1¼ in. wide, made of composition metal. The Babbitt to be ⅝ in. wide in each ring. Steam ports to be 1¾ in. wide and 15 in. long. Exhaust ports to be 1¾ in. wide by 15 in. long, Valves to have 5½ in. greatest travel, 15-16 in. outside lap, and 1-16 in. inside lap on each side of valve.

"Steam-chests to have a horn or pocket projecting in front end for guide to valve-stem. Valve stems to have knuckle joints near the glands of the steam chests. Valve-stem to project in front end of valve-yoke of sufficient length not to be drawn out of pocket while working.

"Piston rods to be of steel and well fitted. All glands to be made of brass.

"Guides to be made of steel, hardened and central with cylinders. Cross-heads to have bearings 14 in. in length in slides, with three Babbitt bars 1¼ in. wide across each bearing surface, one in middle and one near each end.

"Connecting and parallel rods and straps to be of best quality of hammered iron. Length of side or parallel rods, 90 in. from centre to centre of boxes. All brasses to be made hard and well fitted.

"Driving wheels to be 57¾ in. outside diameter, to be fitted with cast-steel flanged tires. Driving axles to be of cast steel. Journals 6¼ in. in diameter. Driving boxes and brasses fitted as per drawing. Driving springs to have 12 leaves ⅝ in. thick, 36 inches long from center to center of hanger. Equalizing lever as per drawing.

"Each eccentric to be fastened on the axle by two set screws; a steel die to be let into each eccentric under the set screw; the die to have teeth cut into it to secure its position in axle.

"Links to be of best iron case-hardened. Link-block to be made of steel, hardened.

"Engines to have one pump on each side. Flanges in pumps and pump chambers to be found, bolted together with four ⅝ in. bolts through each flange. Checks put on as shown in sketch.

"Feed or water pipes to have a cock under foot-board with rods and gauge attached to boiler head, so that the supply of water for the boiler may be regulated by the engineer from the cab.

"Cylinders to be oiled from the cab by pipes placed outside of boiler and under the jacket. Blower pipe to be placed outside of the boiler and under jacket, and to connect with the inside of the cab. Blower and oil pipes to be made of copper.

"Truck frames to be 4 in. wide, and 1¼ thick. The equalizer to be placed on top of the frame. Wheels 28 in. in diameter. Distance between hubs 51⅛ in. Journal 4¼ in. in diameter by 7 in. long. Collars on axles movable and held in place by set screws. Center casting on truck central and fitted to center casting in cylinder. Springs to have 12 leaves, 4 in.x⅜x34 in. between centers of hangers.

"Cab frame to be made of ash, panels of white wood, roofed with pine, covered with tin and wood well dried, and finished and painted with two coats of varnish. Running boards to reach from back ends of cab to an easy stepping distance on steam chest covers. Running boards to be made of ash, 2½ in. thick, bound with brass on outside edge.

"Steam and exhaust pipes of cast iron, to have independent brass-ball joints.

"Throttle lever to be arranged so as to prevent opening and closing, except when moved by engineer. Smoke stack to be made of No. 12 iron. The top of stack to be 13 ft. 10 in. from top of rail.

"Boiler to be lagged with pine and covered with Russia iron and banded with brass bands. Each engine to have one of Richardson's safety-valves fitted to the domes.

"The number of engine to be painted on the sand-box and the sides of tank, also on circular plate on smoke-arch door, and the initials of road on top flanges of tanks. Pilots to be 6 ft. long from center of boiler to point, and to clear 5 in. from rail.

"Engines to have cast iron brackets and boards for head lights.

"Ash pans to extend the whole length of fire-box., to have damper at each end, and stayed with 2 in. angle iron across the ends and sides, and to have sliding doors on each side. Damper to be 8 in.x14 and worked from cab. The furnace to be supplied with air by two rows of hollow stay bolts above the top of fire.

"Engines to have whistle, bell and sand-box, and to be supplied with brass oil cups in both ends of parallel rods and back end of main rods, guides and rocher boxes. All mountings and mouldings for domes, cylinder-heads, steam-chests, etc. to be of cast iron.

"The tanks to be capable of holding 2,200 gallons of water and to carry 5 tons of coal. Top and bottom of tank of 3 16 iron, sides No. 8 iron and well braced. Inside tender frame to be made of oak, and well put together.

"Tender trucks to have two pairs of 30 in. wheels. Truck frames to be of hammered iron, strongly braced, with equalizer on top. Wheel guards over drivers and truck wheels."

So much space has been taken by these specifications that we will postpone further description of the shops and works until next week.

TRAFFIC AND EARNINGS.

The following is from the Oswego *Times:*

"The statement of business for that portion of the New York & Oswego Midland Railroad now completed is most encouraging. For the month of October the gross receipts were $45,000, and operating expenses 50 per cent., leaving net earnings of $22,500. This for twelve months would be $270,000. The coal traffic has since been added, affording gross earnings of $25,000 a month more, and at a better profit than any other portion of its business. The gross earnings with this traffic would be $70,000 per month, or $840,000 per year. It must be borne in mind that the business of the road is now only local, not being able as yet to do its share of trunk line traffic."

—There have been within a few days two shipments of cattle from Utah to New York by way of Chicago. If the freight charges are not too heavy a considerable business of this kind may be expected from Utah and the territories this side of it.

—The Buffalo *Commercial Advertiser* gives the following statistics of the grain trade of Buffalo:

	Flour, bbls.	Grain, bu.	Grain, incl'g Flour, bu.
Received in Nov., 1870	253,084	5,472,123	6,737,543
" " 1869	324,926	4,112,535	5,717,165
	Flour, bbls.	Grain, bu.	Grain, incl'g Flour, bu.
Rec'vd from Jan. 1 to Dec. 1, 1870	1,391,787	37,643,505	44,602,440
" " " " 1869	1,568,021	35,603,263	43,443,367

The following shows the receipts of flour and grain by the Lake Shore & Michigan Southern Railway for the month of November, and from January 1 to December 1, 1870:

	For Month.	From Jan 1 to Dec. 1.
Flour, bbls	220,433	1,250,106
Wheat, bu	131,200	1,389,550
Corn, bu	579,700	4,185,600
Oats, bu	411,200	2,292,700
Barley, bu	5,200	115,340
Rye, bu	16,800	143,400
Total grain, Nov	1,147,100	8,106,490
Total grain, Oct	895,200	

The exports by rail, including through shipments by the Lake Shore road, were 1,990,928 bushels in August, 1,569,179 in September, 1,447,089 in October, and 1,114,894 in November.

Omaha Bridge.

The Omaha *Herald* of last week says:

"The last column of the middle pier of the bridge was yesterday completed. The huge cylinders found a safe resting place upon the rock some seventy feet down in the quicksand, two or three days since, and yesterday the work of filling in with concrete masonry was finished. Four of the eleven piers of the bridge yet remain untouched. Of the seven piers upon which work has been commenced five are firmly planted upon the rocky bottom of the river, and the other two will arrive at the same stage of completion within a few days. The foreman of the work informed us yesterday that they have just got things in good working condition, and that they will be able to accomplish more in the next five months than had been accomplished in the last two years. The piers will be finished by the first of April above high water mark. The material for the superstructure will be brought here this winter, and by the first of May the bridge builders will be at the 'top of their vent' putting on the roadway. It is the purpose of those having this great work in charge to cross trains on this bridge before 'snow flies' in the fall of 1871. They may err in this, but they seem confident now that there is no possibility that their expectations will miscarry."

Chicago Railroad News.

Illinois Central.

By the time table which went into effect last Monday the new St. Louis & Cairo line has three express trains daily. The morning express leaves St. Louis at 10:00 a. m., and the New Orleans fast line at 6:40 p. m. These trains make connections with the Mobile & Ohio Railroad. Two fine new sleeping cars, the "City of New Orleans," and the "City of Mobile," run on this line. Next Monday an important change will be made in the Iowa Division. A passenger train will run regularly between Freeport and Sioux City, a distance of 397 miles. Heretofore there has been a regular passenger only between Dubuque and Fort Dodge, and the connection was made to Sioux City by a mixed train. The Fort Dodge train is continued, so that between Dubuque and Fort Dodge there are now two passenger trains daily.

The following is the report of receipts for the month of November, 1870.

LAND DEPARTMENT.

Acres construction lands sold	3,888.33 for	$36,793 93
Acres interest fund lands sold		
Acres free lands sold	160.00 for	2,961 00
Total sales during month of Nov., 1870	4,048.33 for	$39,754 93
To which add town lot sales		120 00
Total of all	4,048.33 for	$39,874 93
Cash collected in November, 1870		$20,777 78

ESTIMATED EARNINGS—TRAFFIC DEPARTMENT.

	In Illinois, 707 miles.	In Iowa, 400½ miles.	Total. 1107½ mls
Freight	$452,050 00	$91,031 00	$543,081 00
Passenger	135,381 90	44,627 85	180,009 75
Mails	6,375 00	1,029 8	7,404 08
Other Sources	109,000 00	2,495 92	111,495 92
Total, Nov., 1870	$702,806 90	$139,183 85	$841,990 75
Total actual earnings, Nov., 1869	$666,658 35	$147,754 80	$814,413 15
Difference	× $36,248 55	× $8,570 95	+$27,577 60

An increase of 5¼ per cent. on the Illinois lines, a decrease of 5¾ per cent on the Iowa lines, and an increase of 3⅓ per cent. in the total earnings.

Lake Shore & Michigan Southern.

More than one-fifth of all the grain that has been received at Buffalo during the past eleven months, and more than nine-tenths of all the flour, was brought to it by this road. The total amount was 1,250,106 barrels of flour and 8,106,490 bushels of wheat.

Chicago & Alton.

By the table which goes into effect to-morrow (Sunday, December 11), the express mail will leave Chicago at 9.15 a. m., 65 minutes later than heretofore, and reach East St. Louis at 8:30 a. m. The night express will leave at 5.30 p. m., half an hour earlier than heretofore, and arrive at East St. Louis at 6.00 a. m. The morning train leaves daily except Sunday; the 5:30 p. m. train every day but on Saturday, to Bloomington only, where the passenger will lay over till Monday morning. The 9 p. m. train does not leave Saturday and Sunday.

The Joliet accommodation leaves Chicago at 4:00 p. m., 40 minutes earlier than heretofore, and reaches Joliet at 5:55. Returning, it leaves Joliet at 7:50 a. m. and reaches Chicago at 9:45.

The trains from St. Louis northward will run as follows:

Leave St. Louis.	Arrive at Chicago.
*7:40 a. m. express mail.	*8:05 p. m.
†8;00 p. m. lightning express.	*7:30 a. m.
‡5:00 p. m. night express.	

*Except Sundays.
†Except Saturdays.
‡Lies over at Bloomington from Saturday, midnight to 6:30 a. m. Monday, and reaches Chicago at 12:45 p. m.

The earnings for the month of November, reported elsewhere, show the handsome increase of about $35,000, which is about 9 per cent. For the past eleven months the report is as follows:

Passengers	$1,190,992 46
Freight	3, 31,676 78
Mails, etc	215,864 69
Total	$4,438,536 93
Total, 1869	4,340,711 88
Increase	$97,825 05

The increase is about 2⅓ per cent. As will be seen, more than one third of it was made in the month of November.

Michigan Central.

The half-year closed with November. The report of earnings for the twelve months past is as follows:

1869	$4,760,296 69
1870	4,746,657 97
Decrease (¼ of 1 per cent.)	$13,638 72

These earnings are for the 284 miles of the main line only. While they are a very little less than for the previous year, they are larger than for any other year in the history of the road. It was to be expected that there would be a greater decrease, considering the low rates on passengers which continued throughout the six months with the exception of a single week (the last), and the extraordinarily low rate on freight which prevailed for some months. These have been counterbalanced, however, by the great increase in the company's branch lines, which have brought it additional through traffic, and in the great improvement of its Eastern connection, the Great Western Railway, which has never before been operated so safely and regularly.

The prospects for the current half year are very good. The cessation of the ruinous competition between the eastern lines makes it possible for companies to do business at a profit again, and this road is better prepared than it ever has been before, to transact a winter traffic satisfactorily and regularly. This is due chiefly to the improved condition of the Great Western Railway, which, it is said, is now unsurpassed in America and equalled only by our very best lines. Since Mr. Muir was put in charge 143 miles of the 229 have been laid with new rails, 46 with steel rails. Twenty new locomotives of the best American pattern have been purchased, the operation of the line has been made systematic and certain, until now it makes its time as regularly as any road in America, readily making up time when lost by its connections, and very rarely losing any itself.

LOCOMOTIVE STATISTICS.

Michigan Central.

The following is the report of the general average of performance of locomotives on all divisions of the road for the month of October, 1870, as made by A. S. Sweet, Locomotive Superintendent:

Number of freight cars drawn one mile	2,653,671
Equal to cars drawn over entire line	9,388
Number of freight cars drawn one mile in September	2,493,054
Equal to cars drawn over entire line "	8,778
Number of miles run to 1 pint of oil	13 44
" " " 1 cord of wood	34.05
" " " 1 pint of oil in September	14.03
" " " 1 cord of wood "	34.53
Average number of miles run per ton by coal-burning engines	39.56
Average number of miles run to one ton of coal in Sept.	40.30
Average of freight trains cars	22.76
Average size of freight trains in September "	23.25
Number of gallons of oil used	2,3261¼
Number of cords of wood used	5,102
Number of tons of coal used	2,031
Number of miles run by passenger trains	78,187
" " " freight trains	116,154
" " " miscellaneous trains	17,824
" " " training engines	38,052
Total	250,217

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the Company, makes the following report for the month of October, 1870:

Miles run by passenger trains	38,935
" " freight "	88,744
" " miscellaneous "	19,525
Total number of miles run	147,104

The average cost per mile was:

For repairs	4.30 cts.
" oil, waste and tallow	0.83 "
" fuel	8.02 "
" engineers, firemen and wipers	7.75 "
Total cost per mile run	21.50 cts.

The average number of miles run was:

To one ton of coal	40.11
" pint of oil	14.90

Coal is charged at $3.50 per ton. Fifty locomotives made mileage during the month, one was in shop and two were in shop most of the month.

Illinois Central.

The report of S. J. Hayes, Superintendent of Machinery of the Illinois Central Railroad, for the month of September, 1870, affords the following:

Passenger trains	112,257
Freight	283,383
Construction, etc	17,623
Switching	51,049
Total	464,312

The cost per mile run was:

For oil and waste	0.80 cts.
For fuel	6.85 "
For engineers and firemen	6.00 "
For cleaning	1.08 "
For repairs	9.67 "
Total	24.40 cts.

Cost per mile run, in cents:

Passenger engines	16.94 cts.
Freight engines	27.22 "
Construction engines	14.96 "
Switching engines	19.60 "

Average number of miles run to

Pint of oil	13.42
Ton of coal	36.73

Fourteen locomotives are undergoing repairs.

Chicago, Rock Island & Pacific.

The following is the report furnished from the General Superintendent's office for the month of October:

ILLINOIS DIVISION.

The number of miles run by trains was as follows:

Passenger trains	35,730
Freight "	114,288
Miscellaneous "	10,060
Total number of miles run	160,078

The average cost per mile run was:

Fuel	8.27 cts.
Oil and waste	0.64 "
Repairs	5.32 "
Total	14.23 cts.
Engineers, firemen and wipers	6.95 "

Number of miles run to

Pint of oil	17.94
Ton of coal	38.42

IOWA DIVISIONS.

The number of miles run by trains was as follows:

Passenger trains	40,283
Freight "	102,670
Miscellaneous "	27,085
Total	170,238

The average cost per mile run was:

Fuel	7.72 cts.
Oil and waste	0.62 "
Repairs	5.19 "
Total	13.53 cts.
Engineers, firemen and wipers	7.49 "

Average number of miles run to

Pint of oil	18.02
Ton of coal	40.51

The whole number of locomotives owned by the company is 143, of which 70 are on the Iowa divisions and 73 are on the Illinois Division..

No mileage is reported for one locomotive on the Illinois division and one on the Iowa divisions.

The Chicago & Northwestern Dividend.

Has the Chicago & Northwestern Railroad Company fairly earned its dividend of 5 per cent. just declared? This question is asked by some with a certain degree of credulity, and we have therefore made inquiry at the offices of the company for such information as is requisite to an accurate judment on the question. We find that, for the five months ending October 31, while the gross earnings were $157,623 less than for the same period of 1869, the working expenses and taxes were $557,467 lower. The receipts and expenses compare as follows:

	1869.	1870.	Decrease.
Receipts (5 months)	$6,124,433	$5,966,810	$157,623
Expenses (5 months)	3,530,870	2,973,403	557,467

The decrease in the earnings has occurred principally on passengers, the decline on this item being $237,250; while on freight, from which two-thirds of the receipts are derived, there is an increase of $101,014. The reduction in the working expenses is evenly distributed through the various branches of expenditure, but is especially important in the items of cars, fuel, and pay-roll, the reduction in the latter expense being $70,000 in September, $68,000 in October, and for November being estimated at $73,000. In order to afford a fair indication of the manner in which this contraction of expenses (at the rate of $1,335,000 per annum) has been effected, we present the following official statement of the details of expenditures for the five months, ending October 31, in 1869 and 1870 respectively, adding also the receipts from the various sources:

RECEIPTS.

	1869.	1870.
Passengers	$1,855,581 46	$1,621,746 18
Freight	4,030,107 53	4,122,8 7 63
Express	110,094 01	101,549 77
Mail	70,047 21	76,236 58
Miscellaneous	52,601 70	44,439 99
Total	$6,124,433 91	$5,966,810 15

EXPENSES.

Repairs of engines and tenders	$261,225 05	$217,851 89
" " cars	416,322 83	290,900 24
" " buildings	86,276 95	51,394 46
" " fences, gates and crossings	83,684 88	40,090 26
" " bridges and culverts	116,003 98	100,693 13
" " track	797,042 97	744,472 01
" " tools and machinery	72,899 50	48,607 26
Fuel used by locomotives	426,299 75	298,954 92
Fuel and light used on cars and at stations	30,318 74	28,328 90
Oil and waste used	55,669 02	48,812 61
Office and station furniture and expenses	22,334 98	23,9 9 04
Furniture and fixings for cars	7,920 61	5.755 74
Foreign agents	18,228 13	19,787 41
Advertising	10,222 93	5.629 90
Stationery, printed blanks, tickets, etc.	24,939 47	24.836 79
Engineers, firemen and wipers	240,815 16	238,580 80
Conductors, baggagemen and brakemen	161,031 57	161,942 90
Laborers and switchmen at stations	287,784 25	268,403 43
Agents and clerks at stations	211,997 94	192,691 98
Superintendence	33,083 23	30,310 12
Rents	13,709 65	17.535 44
Loss and damage	36, 16 46	25,635 23
Injury to persons	11,932 35	9,905 13
Teaming freight, baggage and mails	4,167 25	4.054 25
Insurance	16,150 12	13,580 00
Miscellaneous expenses	39,872 14	26,095 75
Total	$3,479,458 91	$2,938,868 69
Add for State and county taxes	3,006 19	2,960 75
Add United States tax on earnings	46,778 65	28,794 35
Add United States revenue tax stamps	1,627 19	2,779 24
Total	$3,53 ,870 94	$2,973 403 03

It will be seen from this statement that the expenses have been reduced from 57.65 per cent. of the gross earnings, in 1869, to 49.83 per cent. in 1870.

The whole expenditures of the road for the five months are thus stated on the books of the Company:

Operating expenses (as above)	$2,938,868 69
Taxes of all kinds	34,534 34
Rent of leased roads in Iowa	453,792 01
*Interest on bonds	536,737 50
Interest and exchange	6,187 00
Dividend on Chicago & Milwaukee stock	575 70
Sinking Fund account	15,120 00
Total expenditures (5 months)	$3,985,815 24

* This amount virtually covers the interest on the bonded debt for 6 months, as the amount chargeable in November is but $367.50.

The amount available for dividends out of the five months business, therefore, may be represented thus:

Gross earnings	$5,966,810 15
Total of all expenses	3,985.815 24
Balance of earnings available for dividends	$1,980,994 91
Amount of 5 per cent, dividend on $35,046,922 of stock	1,752,346 00
Cr. Balance after paying dividend	$228,648 91

It is thus seen that the business of the five months provides the entire dividend and leaves a balance of $228,648; to which must be added $541,424 cash balance brought over from last year, and the net earnings of November, estimated at $400,000; making a total balance of $970,000 to the credit of the Company on the six months' account, after paying dividends. The payments in November outside of operating expenses will not exceed $100,000; so that the company enters upon the second half of the year with a clear balance of about $870,000.

The following comparison shows the progress in the net income and in the means available for dividends, the statement being for the five months ending October 31:

	Net income, 5 months.	Total available for dividends at end of 5 months.
1868	$1,805,978 65	$1,826,455 64
1869	1,467,921 36	1,749,695 86
1870	1,980,994 91	2,522,419 20

The increase in the net income of the expired portion of this year exceeds the accrued interest upon the bonds of the road; in other words, the increase in profits is equivalent to the extinction of the annual burden of the debt.

The *Stockholder*, remarking on the dividend, falls into several inaccuracies, and says:

"The disbursements on capital account then will amount as above for the half-year to $3,040,557, which is $518,140 more than the income account showed to its credit on the 1st of this month, which is the last month of the half year upon the profits of which this 5 per cent. dividend is declared. November's net earnings are not likely to reach a half million dollars."

The official figures given above show that the writer has fallen into a very serious error. The balance on income account to which he alludes (amounting to $1,980,994) is the net result after deducting all payments on debt, leases, interest, &c.; and which payments the writer charges a second time against the company, in order to reach the conclusion that the disbursements on capital account exceed the income account by $518,140.

As the Winona & St. Peter Railroad is regarded by some as a burthen upon the Northwestern Company, which wholly owns the road, it may be proper to state that the Winona & St. Peter has a land grant amounting to 6,400 acres per mile, and that the portion constructed by direction of the Northwestern Company, from Waseca westward, is already entitled to upwards of 200,000 acres of fine prairie land in Minnesota, which at the moderate valuation of $5 per acre, is worth over $1,000,000; an asset enuring to the benefit of the Northwestern stockholders, not generally understood either by them or the public.—*New York Bulletin, Dec.* 3.

Fast Trains.

An exchange has a severe criticism upon what is termed the "unfortunate fast-train business between Chicago and New York," and states *authoritatively* "that the expenses of the roads to keep their tracks in a condition of safety and efficiency have been fully one hundred per cent. over ordinary renewal and repairs." We are inclined, with all due deference to our contemporary, to question this position, and believe that, after a careful examination and comparison of working time-tables, it will be found untenable. And first it may be justly asked, have these fast trains been really "unfortunate," either in pecuniary results or the casualties supposed to be incident to such rapid locomotion? If we recollect aright, one of the strongest arguments adduced by the New York Central managers in favor of continuing fast time between New York and Chicago during the past season, was to the effect that the experiment had been virtually forced upon them in the summer of 1869; but results had so far exceeded their expectations, and so fully demonstrated the popularity of fast time, that they were determined to continue the experiment during the summer and fall of 1870. It may be inferred from this, in the absence of any official statistics to the contrary, that the fast trains alluded to between these two important cities have not resulted in any heavy pecuniary loss to the companies interested; and, as no extraordinary casualties have been reported in connection with these trains,—as they have hitherto enjoyed an unparalleled immunity from accident,—they may be pronounced *fortunate*, not *unfortunate*. It may be urged, that extra precautions have been taken to guard against the possibility of injury either to person or property, and that extraordinary expenses nave been incurred on some roads so as to secure a condition of track and equipment fully adequate to the requirements of a high rate of speed; but have not the traveling public been directly benefited by these exertions to maintain a high standard of excellence? Have not the managers been stimulated thereby to remedy original errors of construction, and to reduce the running of trains more to a science than ever before in the records of railroading in this country? Reference to time-tables of certain prominent lines interested in these fast taains will demonstrate that the speed attained is not much in excess of that common to ordinary express trains, and that the time is gained by uniform running and by making few stoppages. For example: on the New York Central Railroad the Special Chicago Express leaves Albany 1:55 p. m., and after making three stops, namely, at Palatine Bridge, Utica and Syracuse, reaches Rochester (a distance of 228½ miles) in six hours and forty-five minutes. Allowing twenty-five minutes for the stops alluded to, the actual running time is found to be six hours and twenty minutes, and the average speed thirty-six miles per hour. The *ordinary* express train leaves Albany 1:20 p. m. makes thirteen stops in the same distance, losing thereby, on a moderate calculatioa, one hour and fifteen minutes in running time, and arrives at Rochester in eight hours. The average speed on this train is thirty-five miles per hour, exclusive of stops; still the propriety of this latter train has never been questioned, and its rate of speed has never been pronounced reckless or unfortunate. As far as wear of machinery and injury to track are concerned, the balance is evidently in favor of the special express, which is a lighter train and conveys almost exclusively through travelers, whose actual expenses to the company should be at any rate one-sixth less than those of ordinary local passengers. Again: on the Pennsylvania Railroad, the fast line west leaves West Philadelphia 12:20 p. m., making two stops in a distance of 355 miles, viz., at Harrisburg and Altoona, and reaches Pittsburgh 12:22 a. m. Allowing forty minutes for the two stoppages, the actual running time is eleven hours and twenty minutes, and the average speed not quite thirty-two miles per hour. Compare these figures with those shown by the schedule of Pittsburgh Express (considered a slow train) between Harrisburg and Altoona, a distance of 132 miles. Time of the fast line with no stops, is three hours and fifty-six minutes; time of Pittsburgh Express, with fourteen stops, five hours and thirty minutes. Allowing one hour and ten minutes for these stops—which is a moderate calculation, considering the delay at stations and the time lost in bringing down and raising the speed from and to the running rate of time—the reader will see that, while the average rate of speed with the fast train is thirty-two and a half miles per hour, and this with a train seldom, if ever, exceeding five cars, the average speed of the Pittsburgh Express, with a train consisting usually of eight or nine cars, is a little more than thirty miles per hour. If the running time of the latter train is not considered inappropriate, that of the former cannot result in much additional expense to the company, nor in extraordinary wear and tear of track and machinery. These two examples, selected at random from the time-tables, indicate conclusively that if the net profits of these fast trains have not been so great as those of other trains, the failure may be traced to causes other than those of fast time; and the remedy lies not in the alteration of time schedules, but in the removal of certain evils which are being engrafted upon the railroad system of this country. First and foremost of these is the unhealthy and absurd competition for traffic by rival lines, which engenders a constant fluctuation of rates for travel, and seriously affects the proprietary interests. Managers should calculate accurately the expenses incident to running their trains, and the minimum profit requisite to repay them for the capital involved, and the risk they run; they should also keep a faithful record of each train's earnings and expenses per mile run; and with these data, rates sufficiently remunerative can be made by the short line to all common points, and should prove acceptable to competing routes having a longer mileage, but geographical advantages, which fully compensate for such increased distance. Rates should be classified according to the speed of trains and operating results. If there is any truth in the old adage, "time is money," a higher rate should be paid by a passenger traveling between Chicago and New York in twenty-seven hours, than by one traversing the same distance in thirty-six hours; and we believe that few would fail to recognize, as in England, the justice and expediency of such extra charge. Equitable and uniform rates cannot, however, be maintained, unless arrangements are made in good faith, and unless executive officers will discard that petty jealousy which induces them to believe that their rivals are attempting to overreach them. Much might be said on this point; but we must investigate another cause which tends, in an equal measure, with low rates and excessive competition, to make through passenger business unremunerative. We allude to the dead weight of rolling-stock, amounting in some instances to more than two tons per passenger carried. It is not increased speed, so much as increased weight of trains, which causes track and superstructure to depreciate rapidly, and which augments in a much greater ratio than heretofore ordinary expenses for repairs and renewal. Managers deprecate in the strongest manner this rapidly-growing evil, but seem powerless in their efforts to avert it; and the committee of master mechanics, to whom this subject was referred, failed in their convention at Philadelphia to report any plan which should relieve their machinery and the track from the severe and unexampled strain to which they are now subjected. It is believed that these palatial cars advertise a route, and that no through line can command its fair proportion of through passenger traffic, without being able to provide sleeping ing and drawing-room cars of the most ornate and recherche description; but statistics, if accurately prepared, would prove it to be a most expensive method of advertising; and if the present system be continued, passengers should be definitely restricted to a certain space in these cars, and the actual dead weight per occupant reduced to the minimum consistent with actual comfort and convenience. A question here arises, whether the cars for through passengers might not consistently be reduced in size, especially when the business is merely in its infancy, and remunerative results are somewhat problematical. Occasionally three or four palace cars destined for as many different points are hauled in one train, and the aggregate of passengers in each would not have completely filled one car; but as the false opinion is entertained that diminutive cars would seriously affect the reputation of any road using them, as their introduction would be at variance with the requirements of an established custom, the folly is perpetuated of maintaining appearances at an actual loss, and operating expenses are considerably in excess of what they would be if outlays were governed by actual results. Railroad management is a science; and it will eventually be demonstrated that it is not the largest passenger equipment which should be run, but that which will afford the best net profit on the passengers carried. On scientific principles alone, three cars forty feet long in a train are much safer and more economical than two cars sixty feet long; and if the latter are constructed on the theory that strength and consequent weight must be in a corresponding ratio with the square of their length, the actual dead weight in proportion to the passengers carried must necessarily be much greater in these than in the former. Enough has perhaps been said to show that in estimating the policy of fast trains, we must look below the surface for the causes which have a tendency, if not checked, to make them unremunerative, and that the high rate of speed is not entirely blamable for the increased ratio of operating expenses with which our contemporary charges it. We live in a fast age; we think fast; we act with energy and rapidity; and, as fast time is entirely consonant with the feelings of this generation, we think that railroad managers have been *fortunate* in demonstrating that, with machinery and equipment superior to those of any other country, they also have a road-bed, superstructure and track on which the running time of English railroads can be rivaled, and this, too, with perfect safety both to life and property.—*Official Railway Guide.*

"The number of engine to be painted on the sand-box and the sides of tank, also on circular plate on smoke-arch door, and the initials of road on top flanges of tanks. Pilots to be 6 ft. long from center of boiler to point, and to clear 5 in. from rail.

"Engines to have cast iron brackets and boards for head lights.

"Ash pans to extend the whole length of fire-box., to have damper at each end, and stayed with 2 in. angle iron across the ends and sides, and to have sliding doors on each side. Damper to be 8 in.x14 and worked from cab. The furnace to be supplied with air by two rows of hollow stay bolts above the top of fire.

"Engines to have whistle, bell and sand-box, and to be supplied with brass oil cups in both ends of parallel rods and back end of main rods, guides and rocher boxes. All mountings and mouldings for domes, cylinder-heads, steam-chests, etc. to be of cast iron.

"The tanks to be capable of holding 2,200 gallons of water and to carry 5 tons of coal. Top and bottom of tank of 3 16 iron, sides No. 8 iron and well braced. Inside tender frame to be made of oak, and well put together.

"Tender trucks to have two pairs of 30 in. wheels. Truck frames to be of hammered iron, strongly braced, with equalizer on top. Wheel guards over drivers and truck wheels."

So much space has been taken by these specifications that we will postpone further description of the shops and works until next week.

TRAFFIC AND EARNINGS.

The following is from the Oswego *Times*:

"The statement of business for that portion of the New York & Oswego Midland Railroad now completed is most encouraging. For the month of October the gross receipts were $45,000, and operating expenses 50 per cent., leaving net earnings of $22,500. This for twelve months would be $270,000. The coal traffic has since been added, affording gross earnings of $25,000 a month more, and at a better profit than any other portion of its business. The gross earnings with this traffic would be $70,000 per month, or $840,000 per year. It must be borne in mind that the business of the road is now only local, not being able as yet to do its share of trunk line traffic."

—There have been within a few days two shipments of cattle from Utah to New York by way of Chicago. If the freight charges are not too heavy a considerable business of this kind may be expected from Utah and the territories this side of it.

—The Buffalo *Commercial Advertiser* gives the following statistics of the grain trade of Buffalo:

	Flour, bbls.	Grain, bu.	Grain, incl'g Flour, bu.
Received in Nov., 1870	253,084	5,472,123	6,737,543
" " 1869	32[illegible],926	4,1[illegible]2,535	5,717,165
	Flour, bbls.	Grain, bu.	Grain, incl'g Flour, bu.
Rec'vd from Jan. 1 to Dec. 1, 1870	1,391,787	37,643,505	44,602,440
" " " " 1869	1,568,021	35,6[illegible]3,262	43,443,367

The following shows the receipts of flour and grain by the Lake Shore & Michigan Southern Railway for the month of November, and from January 1 to December 1, 1870:

	For Month.	From Jan 1 to Dec. 1.
Flour, bbls	220,433	1,250,106
Wheat, bu	131,200	1,389,550
Corn, bu	579,700	4,185,600
Oats, bu	411,200	2,292,700
Barley, bu	5,200	115,340
Rye, bu	16,800	143,400
Total grain, Nov	1,147,100	8,106,490
Total grain, Oct	895,200	

The exports by rail, including through shipments by the Lake Shore road, were 1,990,928 bushels in August, 1,569,179 in September, 1,447,089 in October, and 1,114,894 in November.

Omaha Bridge.

The Omaha *Herald* of last week says:

"The last column of the middle pier of the bridge was yesterday completed. The huge cylinders found a safe resting place upon the rock some seventy feet down in the quicksand, two or three days since, and yesterday the work of filling in with concrete masonry was finished. Four of the eleven piers of the bridge yet remain untouched. Of the seven piers upon which work has been commenced five are firmly planted upon the rocky bottom of the river, and the other two will arrive at the same stage of completion within a few days. The foreman of the work informed us yesterday that they have just got things in good working condition, and that they will be able to accomplish more in the next five months than had been accomplished in the last two years. The piers will be finished by the first of April above high water mark. The material for the superstructure will be brought here this winter, and by the first of May the bridge builders will be at the 'top of their vent' putting on the roadway. It is the purpose of those having this great work in charge to cross trains on this bridge before 'snow flies' in the fall of 1871. They may err in this, but they seem confident now that there is no possibility that their expectations will miscarry."

Chicago Railroad News.

Illinois Central.

By the time table which went into effect last Monday the new St. Louis & Cairo line has three express trains daily. The morning express leaves St. Louis at 10:00 a. m., and the New Orleans fast line at 6:40 p. m. These trains make connections with the Mobile & Ohio Railroad. Two fine new sleeping cars, the "City of New Orleans," and the "City of Mobile," run on this line. Next Monday an important change will be made in the Iowa Division. A passenger train will run regularly between Freeport and Sioux City, a distance of 397 miles. Heretofore there has been a regular passenger only between Dubuque and Fort Dodge, and the connection was made to Sioux City by a mixed train. The Fort Dodge train is continued, so that between Dubuque and Fort Dodge there are now two passenger trains daily.

The following is the report of receipts for the month of November, 1870.

LAND DEPARTMENT.

Acres construction lands sold	3,888.33	for	$36,793 93
Acres interest fund lands sold	..		
Acres free lands sold	160.00	for	2,961 00
Total sales during month of Nov., 1870	4,048.33	for	$39,754 93
To which add town lot sales			120 00
Total of all	4,048.33	for	$39,874 93
Cash collected in November, 1870			$20[illegible],777 78

ESTIMATED EARNINGS—TRAFFIC DEPARTMENT.

	In Illinois, 707 miles.	In Iowa, 400¼ miles.	Total. 1107½ mls
Freight	$452,050 00	$91,031 0[illegible]	$[illegible]43,081 00
Passenger	135,381 50	44,627 85	180,009 75
Mails	6,375 00	1,029 8[illegible]	7,404 08
Other Sources	109,000 00	2,495 92	111,495 92
Total, Nov., 1870	$702,806 9[illegible]	$139,183 85	$841,990 75
Total actual earnings, Nov., 1869	$666,658 35	$147,754 80	$814,413 15
Difference	×$36,248 55	×$8,570 95	-$27,577 60

An increase of 5½ per cent. on the Illinois lines, a decrease of 5¾ per cent on the Iowa lines, and an increase of 3⅓ per cent. in the total earnings.

Lake Shore & Michigan Southern.

More than one-fifth of all the grain that has been received at Buffalo during the past eleven months, and more than nine-tenths of all the flour, was brought to it by this road. The total amount was 1,250,106 barrels of flour and 8,106,490 bushels of wheat.

Chicago & Alton.

By the table which goes into effect to-morrow (Sunday, December 11), the express mail will leave Chicago at 9.15 a. m., 65 minutes later than heretofore, and reach East St. Louis at 8:30 a. m. The night express will leave at 5.30 p. m., half an hour earlier than heretofore, and arrive at East St. Louis at 6.00 a. m. The morning train leaves daily except Sunday; the 5:30 p. m. train every day but on Saturday, to Bloomington only, where the passenger will lay over till Monday morning. The 9 p. m. train does not leave Saturday and Sunday.

The Joliet accommodation leaves Chicago at 4:00 p. m., 40 minutes earlier than heretofore, and reaches Joliet at 5:55. Returning, it leaves Joliet at 7:50 a. m. and reaches Chicago at 9:45.

The trains from St. Louis northward will run as follows:

Leave St. Louis.	Arrive at Chicago.
*7:40 a. m. express mail.	*8:05 p. m.
†8;00 p. m. lightning express.	*7:30 a. m.
‡5:00 p. m. night express.	

*Except Sundays.
†Except Saturdays.
‡Lies over at Bloomington from Saturday, midnight to 6:30 a. m. Monday, and reaches Chicago at 12:45 p. m.

The earnings for the month of November, reported elsewhere, show the handsome increase of about $35,000, which is about 9 per cent. For the past eleven months the report is as follows:

Passengers	$1,190,992 46
Freight	3, 31,676 78
Mails, etc	215,864 69
Total	$4,438,536 93
Total, 1869	4,340,711 88
Increase	$97,825 05

The increase is about 2⅓ per cent. As will be seen, more than one third of it was made in the month of November.

Michigan Central.

The half-year closed with November. The report of earnings for the twelve months past is as follows:

1869	$4,760,296 69
1870	4,746,657 97
Decrease (¼ of 1 per cent.)	$13,638 72

These earnings are for the 284 miles of the main line only. While they are a very little less than for the previous year, they are larger than for any other year in the history of the road. It was to be expected that there would be a greater decrease, considering the low rates on passengers which continued throughout the six months with the exception of a single week (the last), and the extraordinarily low rate on freight which prevailed for some months. These have been counterbalanced, however, by the great increase in the company's branch lines, which have brought it additional through traffic, and in the great improvement of its Eastern connection, the Great Western Railway, which has never before been operated so safely and regularly.

The prospects for the current half year are very good. The cessation of the ruinous competition between the eastern lines makes it possible for companies to do business at a profit again, and this road is better prepared than it ever has been before, to transact a winter traffic satisfactorily and regularly. This is due chiefly to the improved condition of the Great Western Railway, which, it is said, is now unsurpassed in America and equalled only by our very best lines. Since Mr. Muir was put in charge 143 miles of the 229 have been laid with new rails, 46 with steel rails. Twenty new locomotives of the best American pattern have been purchased, the operation of the line has been made systematic and certain, until now it makes its time as regularly as any road in America, readily making up time when lost by its connections, and very rarely losing any itself.

LOCOMOTIVE STATISTICS.

Michigan Central.

The following is the report of the general average of performance of locomotives on all divisions of the road for the month of October, 1870, as made by A. S. Sweet, Locomotive Superintendent:

Number of freight cars drawn one mile	2,653,671
Equal to cars drawn over entire line	9,3[illegible]8
Number of freight cars drawn one mile in September	2,493,054
Equal to cars drawn over entire line "	8,778
Number of miles run to 1 pint of oil	13 44
" " " 1 cord of wood	34.05
" " " 1 pint of oil in September	14.03
" " " 1 cord of wood "	34.53
Average number of miles run per ton by coal-burning engines	39.56
Average number of miles run to one ton of coal in Sept.	40.30
Average of freight trains cars	22.76
Average size of freight trains in September "	23.25
Number of gallons of oil used	2,326¼
Number of cords of wood used	5,102
Number of tons of coal used	2,031
Number of miles run by passenger trains	78,187
" " " freight trains	116,154
" " " miscellaneous trains	17,824
" " " training engines	38,052
Total	250,217

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the Company, makes the following report for the month of October, 1870:

Miles run by passenger trains	38,835
" " freight "	88,744
" " miscellaneous "	19,525
Total number of miles run	147,104

The average cost per mile was:

For repairs	4.30 cts.
" oil, waste and tallow	0.83 "
" fuel	8.62 "
" engineers, firemen and wipers	7.75 "
Total cost per mile run	21.50 cts.

The average number of miles run was:

To one ton of coal	40.11
" pint of oil	14.90

Coal is charged at $3.50 per ton. Fifty locomotives made mileage during the month, one was in shop and two were in shop most of the month.

Illinois Central.

The report of S. J. Hayes, Superintendent of Machinery of the Illinois Central Railroad, for the month of September, 1870, affords the following:

Passenger trains	112,257
Freight	283,383
Construction, etc	17,623
Switching	51,049
Total	464,312

The cost per mile run was:

For oil and waste	0.80 cts.
For fuel	6.85 "
For engineers and firemen	6.00 "
For cleaning	1.08 "
For repairs	9.67 "
Total	24.40 cts.

Cost per mile run, in cents:

Passenger engines	16.94 cts.
Freight engines	27.22 "
Construction engines	14.96 "
Switching engines	19.60 "

Average number of miles run to

Pint of oil	13.42
Ton of coal	36.73

Fourteen locomotives are undergoing repairs.

Chicago, Rock Island & Pacific.

The following is the report furnished from the General Superintendent's office for the month of October:

ILLINOIS DIVISION.

The number of miles run by trains was as follows:

Passenger trains	35,730
Freight "	114,288
Miscellaneous "	10,060
Total number of miles run	160,078

The average cost per mile run was:

Fuel	8.27 cts.
Oil and waste	0.64 "
Repairs	5.32 "
Total	14.23 cts.
Engineers, firemen and wipers	6.95 "

Number of miles run to

Pint of oil	17.94
Ton of coal	38.42

IOWA DIVISIONS.

The number of miles run by trains was as follows:

Passenger trains	40,283
Freight "	102,870
Miscellaneous "	27,085
Total	170,238

The average cost per mile run was:

Fuel	7.72 cts.
Oil and waste	0.62 "
Repairs	5.19 "
Total	13.53 cts.
Engineers, firemen and wipers	7.49 "

Average number of miles run to

Pint of oil	18.02
Ton of coal	40.51

The whole number of locomotives owned by the company is 143, of which 70 are on the Iowa divisions and 73 are on the Illinois Division..

No mileage is reported for one locomotive on the Illinois division and one on the Iowa divisions.

The Chicago & Northwestern Dividend.

Has the Chicago & Northwestern Railroad Company fairly earned its dividend of 5 per cent. just declared? This question is asked by some with a certain degree of credulity, and we have therefore made inquiry at the offices of the company for such information as is requisite to an accurate judment on the question. We find that, for the five months ending October 31, while the gross earnings were $157,623 less than for the same period of 1869, the working expenses and taxes were $557,467 lower. The receipts and expenses compare as follows:

	1869.	1870.	Decrease.
Receipts (5 months)	$6,124,433	$5,966,810	$157,623
Expenses (5 months)	3,530,870	2,973,403	557,467

The decrease in the earnings has occurred principally on passengers, the decline on this item being $237,250; while on freight, from which two-thirds of the receipts are derived, there is an increase of $101,014. The reduction in the working expenses is evenly distributed through the various branches of expenditure, but is especially important in the items of cars, fuel, and pay-roll, the reduction in the latter expense being $70,000 in September, $68,000 in October, and for November being estimated at $73,000. In order to afford a fair indication of the manner in which this contraction of expenses (at the rate of $1,335,000 per annum) has been effected, we present the following official statement of the details of expenditures for the five months, ending October 31, in 1869 and 1870 respectively, adding also the receipts from the various sources:

RECEIPTS.

	1869.	1870.
Passengers	$1,855,581 46	$1,621,746 18
Freight	4,030,107 53	4,122,8 7 63
Express	118,09[illegible] 01	101,549 77
Mail	70,047 21	76,236 58
Miscellaneous	52.601 70	44,439 99
Total	$6,124,433 91	$5,966,810 15

EXPENSES.

Repairs of engines and tenders	$261,225 05	$217,851 89
" " cars	416,322 83	290,900 24
" " buildings	86,276 95	51,394 46
" " fences, gates and crossings	83,684 88	40,090 26
" " bridges and culverts	116,003 98	100,693 13
" " track	797,042 97	744,472 01
" " tools and machinery	72,899 50	48,6[illegible]7 26
Fuel used by locomotives	426,299 75	298,954 92
Fuel and light used on cars and at stations	30,318 74	28,328 90
Oil and waste used	55,669 02	48,8[illegible]2 61
Office and station furniture and expenses	22,334 98	23,9[illegible]9 04
Furniture and fixings for cars	7,920 61	5.755 74
Foreign agents	18,228 13	19,787 41
Advertising	10,222 93	5.629 90
Stationery, printed blanks, tickets, etc.	24,939 47	24.836 79
Engineers, firemen and wipers	240,815 16	238,580 80
Conductors, baggagemen and brakemen	161,031 57	161,942 90
Laborers and switchmen at stations	287,784 25	268,403 43
Agents and clerks at stations	211.997 94	192,691 98
Superintendence	33.083 23	30.310 12
Rents	13,7[illegible]9 65	17.535 44
Loss and damage	36, 16 46	25,635 23
Injury to persons	11.032 35	9.905 13
Teaming freight, baggage and mails	4,167 25	4.054 25
Insurance	16.159 12	13.580 00
Miscellaneous expenses	33.872 14	26,095 75
Total	$3,479,458 91	$2,938,868 69
Add for State and county taxes	3,006 19	2,960 75
Add United States tax on earnings	46,778 65	28,794 35
Add United States revenue tax stamps	1,637 19	2,779 24
Total	$3,53 ,870 94	$2,973 403 03

It will be seen from this statement that the expenses have been reduced from 57.65 per cent. of the gross earnings, in 1869, to 49.83 per cent. in 1870.

The whole expenditures of the road for the five months are thus stated on the books of the Company:

Operating expenses (as above)	$2,938,868 69
Taxes of all kinds	34,534 34
Rent of leased roads in Iowa	453,792 01
*Interest on bonds	536,737 50
Interest and exchange	6,187 00
Dividend on Chicago & Milwaukee stock	575 70
Sinking Fund account	15,130 00
Total expenditures (5 months)	$3,985,815 24

* This amount virtually covers the interest on the bonded debt for 6 months, as the amount chargeable in November is but $367.50.

The amount available for dividends out of the five months business, therefore, may be represented thus:

Gross earnings	$5,966,810 15
Total of all expenses	3,985,815 24
Balance of earnings available for dividends	$1,980,994 91
Amount of 5 per cent, dividend on $35,046,922 of stock	1,752,346 00
Cr. Balance after paying dividend	$228,648 91

It is thus seen that the business of the five months provides the entire dividend and leaves a balance of $228,648; to which must be added $541,424 cash balance brought over from last year, and the net earnings of November, estimated at $400,000; making a total balance of $970,000 to the credit of the Company on the six months' account, after paying dividends. The payments in November outside of operating expenses will not exceed $100,000; so that the company enters upon the second half of the year with a clear balance of about $870,000.

The following comparison shows the progress in the net income and in the means available for dividends, the statement being for the five months ending October 31:

	Net income, 5 months.	Total available for dividends at end of 5 months.
1868	$1,805,978 65	$1,826,455 64
1869	1,467,921 36	1,749,695 86
1870	1,930,994 91	2,522,419 20

The increase in the net income of the expired portion of this year exceeds the accrued interest upon the bonds of the road; in other words, the increase in profits is equivalent to the extinction of the annual burden of the debt.

The *Stockholder*, remarking on the dividend, falls into several inaccuracies, and says:

"The disbursements on capital account then will amount as above for the half-year to $3,040,557, which is $518,140 more than the income account showed to its credit on the 1st of this month, which is the last month of the half year upon the profits of which this 5 per cent. dividend is declared. November's net earnings are not likely to reach a half million dollars."

The official figures given above show that the writer has fallen into a very serious error. The balance on income account to which he alludes (amounting to $1,980,994) is the net result after deducting all payments on debt, leases, interest, &c.; and which payments the writer charges a second time against the company, in order to reach the conclusion that the disbursements on capital account exceed the income account by $518,140.

As the Winona & St. Peter Railroad is regarded by some as a burthen upon the Northwestern Company, which wholly owns the road, it may be proper to state that the Winona & St. Peter has a land grant amounting to 6,400 acres per mile, and that the portion constructed by direction of the Northwestern Company, from Waseca westward, is already entitled to upwards of 200,000 acres of fine prairie land in Minnesota, which at the moderate valuation of $5 per acre, is worth over $1,000,000; an asset enuring to the benefit of the Northwestern stockholders, not generally understood either by them or the public.—*New York Bulletin, Dec.* 3.

Fast Trains.

An exchange has a severe criticism upon what is termed the "unfortunate fast-train business between Chicago and New York," and states *authoritatively* "that the expenses of the roads to keep their tracks in a condition of safety and efficiency have been fully one hundred per cent. over ordinary renewal and repairs." We are inclined, with all due deference to our contemporary, to question this position, and believe that, after a careful examination and comparison of working time-tables, it will be found untenable. And first it may be justly asked, have these fast trains been really "unfortunate," either in pecuniary results or the casualties supposed to be incident to such rapid locomotion? If we recollect aright, one of the strongest arguments adduced by the New York Central managers in favor of continuing fast time between New York and Chicago during the past season, was to the effect that the experiment had been virtually forced upon them in the summer of 1869; but results had so far exceeded their expectations, and so fully demonstrated the popularity of fast time, that they were determined to continue the experiment during the summer and fall of 1870. It may be inferred from this, in the absence of any official statistics to the contrary, that the fast trains alluded to between these two important cities have not resulted in any heavy pecuniary loss to the companies interested; and, as no extraordinary casualties have been reported in connection with these trains,—as they have hitherto enjoyed an unparalleled immunity from accident,—they may be pronounced *fortunate*, not *unfortunate*. It may be urged, that extra precautions have been taken to guard against the possibility of injury either to person or property, and that extraordinary expenses nave been incurred on some roads so as to secure a condition of track and equipment fully adequate to the requirements of a high rate of speed; but have not the traveling public been directly benefited by these exertions to maintain a high standard of excellence? Have not the managers been stimulated thereby to remedy original errors of construction, and to reduce the running of trains more to a science than ever before in the records of railroading in this country? Reference to time-tables of certain prominent lines interested in these fast taains will demonstrate that the speed attained is not much in excess of that common to ordinary express trains, and that the time is gained by uniform running and by making few stoppages. For example: on the New York Central Railroad the Special Chicago Express leaves Albany 1:55 p. m., and after making three stops, namely, at Palatine Bridge, Utica and Syracuse, reaches Rochester (a distance of 228½ miles) in six hours and forty-five minutes. Allowing twenty-five minutes for the stops alluded to, the actual running time is found to be six hours and twenty minutes, and the average speed thirty-six miles per hour. The *ordinary* express train leaves Albany 1:20 p. m. makes thirteen stops in the same distance, losing thereby, on a moderate calculatioa, one hour and fifteen minutes in running time, and arrives at Rochester in eight hours. The average speed on this train is thirty-five miles per hour, exclusive of stops; still the propriety of this latter train has never been questioned, and its rate of speed has never been pronounced reckless or unfortunate. As far as wear of machinery and injury to track are concerned, the balance is evidently in favor of the special express, which is a lighter train and conveys almost exclusively through travelers, whose actual expenses to the company should be at any rate one-sixth less than those of ordinary local passengers. Again: on the Pennsylvania Railroad, the fast line west leaves West Philadelphia 12:20 p. m., making two stops in a distance of 355 miles, viz., at Harrisburg and Altoona, and reaches Pittsburgh 12:22 a. m. Allowing forty minutes for the two stoppages, the actual running time is eleven hours and twenty minutes, and the average speed not quite thirty-two miles per hour. Compare these figures with those shown by the schedule of Pittsburgh Express (considered a slow train) between Harrisburg and Altoona, a distance of 132 miles. Time of the fast line with no stops, is three hours and fifty-six minutes; time of Pittsburgh Express, with fourteen stops, five hours and thirty minutes. Allowing one hour and ten minutes for these stops—which is a moderate calculation, considering the delay at stations and the time lost in bringing down and raising the speed from and to the running rate of time—the reader will see that, while the average rate of speed with the fast train is thirty-two and a half miles per hour, and this with a train seldom, if ever, exceeding five cars, the average speed of the Pittsburgh Express, with a train consisting usually of eight or nine cars, is a little more than thirty miles per hour. If the running time of the latter train is not considered inappropriate, that of the former cannot result in much additional expense to the company, nor in extraordinary wear and tear of track and machinery. These two examples, selected at random from the time-tables, indicate conclusively that if the net profits of these fast trains have not been so great as those of other trains, the failure may be traced to causes other than those of fast time; and the remedy lies not in the alteration of time schedules, but in the removal of certain evils which are being engrafted upon the railroad system of this country. First and foremost of these is the unhealthy and absurd competition for traffic by rival lines, which engenders a constant fluctuation of rates for travel, and seriously affects the proprietary interests. Managers should calculate accurately the expenses incident to running their trains, and the minimum profit requisite to repay them for the capital involved, and the risk they run; they should also keep a faithful record of each train's earnings and expenses per mile run; and with these data, rates sufficiently remunerative can be made by the short line to all common points, and should prove acceptable to competing routes having a longer mileage, but geographical advantages, which fully compensate for such increased distance. Rates should be classified according to the speed of trains and operating results. If there is any truth in the old adage, "time is money," a higher rate should be paid by a passenger traveling between Chicago and New York in twenty-seven hours, than by one traversing the same distance in thirty-six hours; and we believe that few would fail to recognize, as in England, the justice and expediency of such extra charge. Equitable and uniform rates cannot, however, be maintained, unless arrangements are made in good faith, and unless executive officers will discard that petty jealousy which induces them to believe that their rivals are attempting to overreach them. Much might be said on this point; but we must investigate another cause which tends, in an equal measure, with low rates and excessive competition, to make through passenger business unremunerative. We allude to the dead weight of rolling-stock, amounting in some instances to more than two tons per passenger carried. It is not increased speed, so much as increased weight of trains, which causes track and superstructure to depreciate rapidly, and which augments in a much greater ratio than heretofore ordinary expenses for repairs and renewal. Managers deprecate in the strongest manner this rapidly-growing evil, but seem powerless in their efforts to avert it; and the committee of master mechanics, to whom this subject was referred, failed in their convention at Philadelphia to report any plan which should relieve their machinery and the track from the severe and unexampled strain to which they are now subjected. It is believed that these palatial cars advertise a route, and that no through line can command its fair proportion of through passenger traffic, without being able to provide sleeping ing and drawing-room cars of the most ornate and recherche description; but statistics, if accurately prepared, would prove it to be a most expensive method of advertising; and if the present system be continued, passengers should be definitely restricted to a certain space in these cars, and the actual dead weight per occupant reduced to the minimum consistent with actual comfort and convenience. A question here arises, whether the cars for through passengers might not consistently be reduced in size, especially when the business is merely in its infancy, and remunerative results are somewhat problematical. Occasionally three or four palace cars destined for as many different points are hauled in one train, and the aggregate of passengers in each would not have completely filled one car; but as the false opinion is entertained that diminutive cars would seriously affect the reputation of any road using them, as their introduction would be at variance with the requirements of an established custom, the folly is perpetuated of maintaining appearances at an actual loss, and operating expenses are considerably in excess of what they would be if outlays were governed by actual results. Railroad management is a science; and it will eventually be demonstrated that it is not the largest passenger equipment which should be run, but that which will afford the best net profit on the passengers carried. On scientific principles alone, three cars forty feet long in a train are much safer and more economical than two cars sixty feet long; and if the latter are constructed on the theory that strength and consequent weight must be in a corresponding ratio with the square of their length, the actual dead weight in proportion to the passengers carried must necessarily be much greater in these than in the former. Enough has perhaps been said to show that in estimating the policy of fast trains, we must look below the surface for the causes which have a tendency, if not checked, to make them unremunerative, and that the high rate of speed is not entirely blamable for the increased ratio of operating expenses with which our contemporary charges it. We live in a fast age; we think fast; we act with energy and rapidity; and, as fast time is entirely consonant with the feelings of this generation, we think that railroad managers have been *fortunate* in demonstrating that, with machinery and equipment superior to those of any other country, they also have a road-bed, superstructure and track on which the running time of English railroads can be rivaled, and this, too, with perfect safety both to life and property.—*Official Railway Guide.*

The Economy of Good Rails.

There can be no doubt that some progress has been made within a few years in the rail question. When managers become alive to the importance oi using only good rails, and care more for the quality than for the price a most substantial benefit will have been secured. A "life" of ten years or twelve years for iron rails, on roads with moderately heavy traffic, can be secured, if managers are willing to pay a fair price to the manufacturers and insist upon the proper guaranties. This has been proved by experience upon prominent New England roads, and yet many managers have bought, and still continue to buy, rails that last only from two to four years because they can get them at a cheap price. The difference in the cost of the rails that last only two years and those that can be depended upon for ten years, is probably not more than -wenty-five per cent. at the outside, and yet how few economical managers are willing to pay that amount for the better article, although the substantial economy of the operation is seen at a glance. No railway company can afford to buy poor material of any kind either for superstructure or rolling stock. A saving of a thousand dollars in the first cost of a locomotive is the cause of a loss of several thousand in the course of a year or two in the shape of repairs of breakages, to say nothing of the inconvenience and detentions ensuing. And this applies even more strongly to the rail question. A superstructure that is constantly breaking and giving way, requiring patching and relaying from day to day, is one of the most expensive luxuries that railway managers can indulge in. Besides its early decay and rapid destruction it is the prime cause of rapid destruction to the rolling stock and is the parent of all kinds of disasters incidental to railway operation. Real economy is subserved only by using the best material that money can purchase. It would seem that the extended experience of the poor economy of using cheap rails, whether of iron or steel, has been sufficient to prevent any manager from continuing the practice, but it does not seem to be sufficient as yet, and we find some of them haggling about a few dollars more or less per ton, that sum representing the difference between the shoddy and the really useful and economical article. The true policy is to buy the best, and make the manufacturers responsible for the wear. The system of guaranties that many European roads require from the manufacturers is judicious, and may well be established in this country. This system makes the manufacturers replace all broken or unsound rails that are found in the track within a certain specified time say from two to four years as the case may be. This penalty for delivering bad work is a deserved one, and if insisted upon rigidly, insures the production of a really good article, for which the manufacturer gets a fair price, and the railway company makes a good bargain inasmuch as it gets a good serviceable article and insures itself against that large class of accidents and disasters resulting from an unsound superstructure. —*American Railway Times.*

Houston & Texas Central.

This road has recently been opened to Kosse, 153 miles north of Houston and ten miles north of Bremond, which latter road was the northern terminus until lately.

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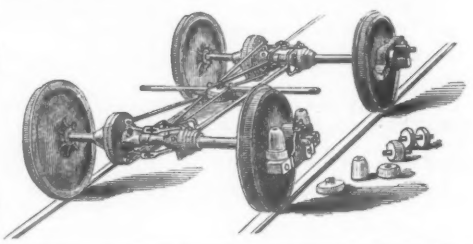

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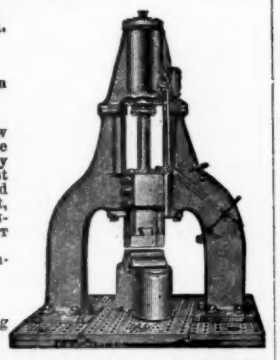

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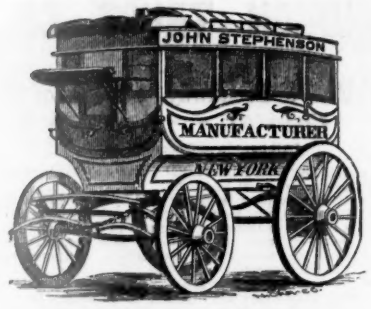

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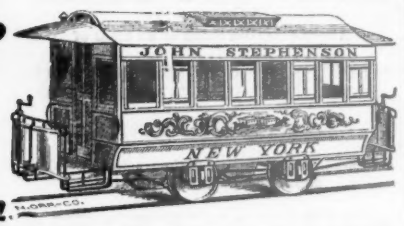

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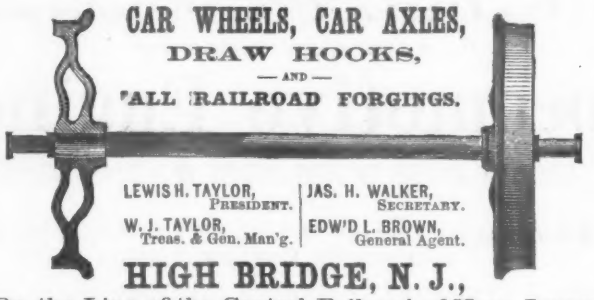

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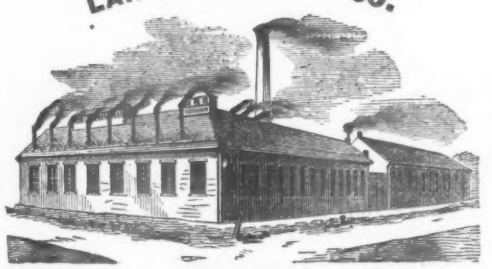

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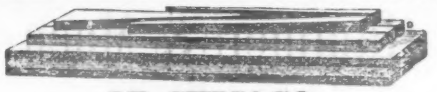

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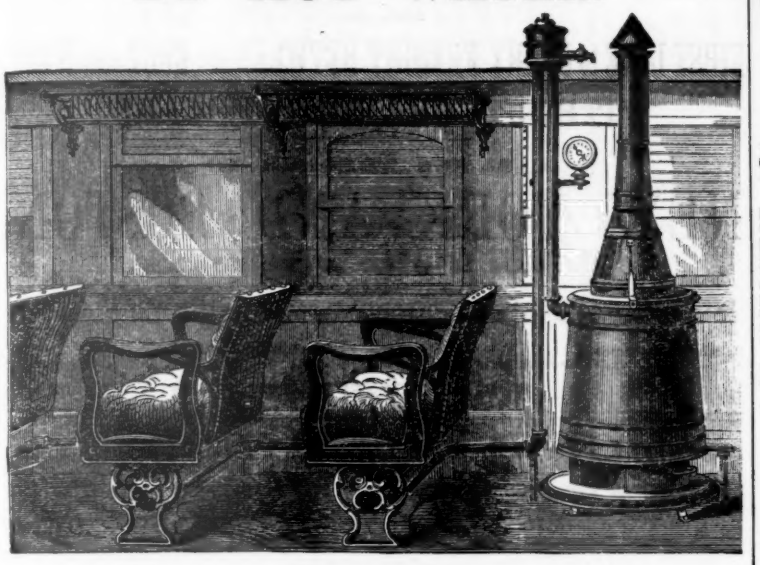

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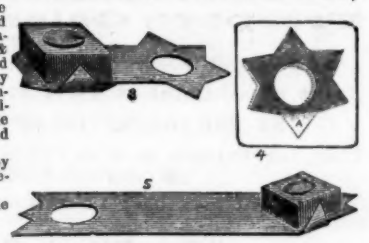

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The Chicago Spring Works.

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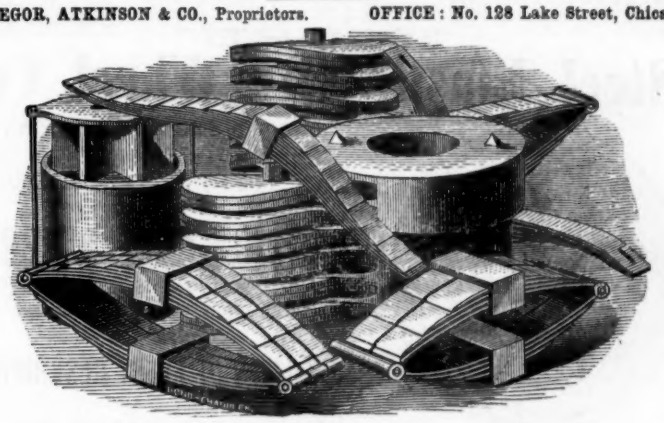
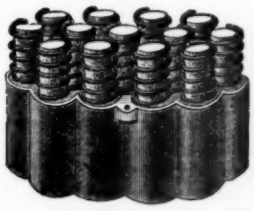


MANUFACTURERS OF

EXTRA TEMPERED LIGHT ELLIPTIC CAST STEEL SPRINGS AND THE "DANIELS" PAT. CAR SPRING.

Union Car Spring Mf'g Co.

Sole Proprietors of the



Wool-Packed Spiral.

Hebbard.

HEBBARD CAR SPRING!

Offices: No. 4 Dey St., New York, and 19 Wells St., Chicago.

FACTORIES: JERSEY CITY, N. J., and SPRINGFIELD, MASS.

Vose, Dinsmore & Co.,

NATIONAL SPRING WORKS,

MANUFACTURERS OF

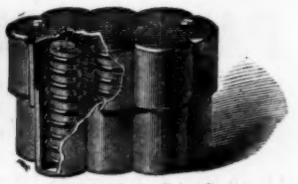
VOLUTE BUFFER, INDIA RUBBER, RUBBER CENTER SPIRAL, COMPOUND SPIRAL, "DINSMORE,"

AND OTHER

RAILWAY CAR SPRINGS.

"Dinsmore" Spring.

Volute Buffer Spring.



Group Rubber Center Spiral Spring.

No. 1 Barclay St., NEW YORK. | No. 15 La Salle St., CHICAGO,

WORKS ON 129th AND 130th STREETS, NEW YORK.

GENERAL FREIGHT DEPARTMENT.

The Illinois Central Railroad

ARE PREPARED TO TAKE FREIGHT FOR

Cairo, St. Louis, Peoria,

BLOOMINGTON, SPRINGFIELD, JACKSONVILLE,

And All Points in the Central and Southern parts of the State:

MOBILE & NEW ORLEANS BY RAIL OR RIVER

And ALL POINTS on the MISSISSIPPI below CAIRO. Also, to

Freeport, Galena and Dubuque.

☞ Freight Forwarded with Promptness and Despatch, and Rates at all times as LOW as by any other Route.

BY THE COMPLETION OF THE BRIDGE AT DUNLEITH,

THEY ARE ENABLED TO TAKE FREIGHT TO ALL POINTS WEST OF DUBUQUE ☞ WITHOUT CHANGE OF CARS! ☜

DELIVER FREIGHT IN CHICAGO ONLY at the FREIGHT DEPOT of the Company, foot of South Water St. Parties ordering Goods from the East should have the packages marked:

"Via Illinois Central Railroad."

For **THROUGH BILLS OF LADING**, and further information, apply to the LOCAL FREIGHT AGENT at Chicago, or to the undersigned.

M. HUGHITT, Gen. Supt. J. F. TUCKER, Gen. Freight Agt.

MOORE

Steel Elastic Car Wheel Co.

OF NEW JERSEY.

Proprietors of

MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.

American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.

CHAS. J. PUSEY, **P. O. Address—Box 5222.** EDW'D H. PARDEE

Pusey & Pardee,

74 BROADWAY, NEW YORK.

American and English Rails,

LOCOMOTIVES AND CARS FISH-PLATES, SPIKES, &c.

—SOLE AGENTS FOR—

Atkins Brothers' Pottsville Rolling Mills, and G. Buchanan & Co., of London.

☞ Special attention given to filling orders for small T and **STREET RAILS**, of every weight and pattern.

OLD RAILS BOUGHT OR RE-ROLLED, AS DESIRED.

J. E. FRENCH. W. S. DODGE. D. W. CROSS.

Winslow Car Roofing Company.

PATENT IRON CAR ROOFS.

Established, 1859.

No. 211 Superior St. CLEVELAND, O.

Over 20,000 Cars covered with this Roof! We claim that these Roofs will keep Cars dry, and will last as long as the Cars they cover without any extra expense after once put on.

☞ SEND FOR CIRCULARS.

THE

"RED LINE!"

—RUNNING OVER THE—

Michigan Southern and Lake Shore R. R.'s,

—WAS THE—

FIRST LINE to CARRY FREIGHT BETWEEN the EAST and WEST,

WITHOUT CHANGE OF CARS!

CARS RUN THROUGH TO

NEW YORK AND BOSTON,

IN FOUR AND FIVE DAYS!

☞ Contracts made at the Offices of the Line. ☜

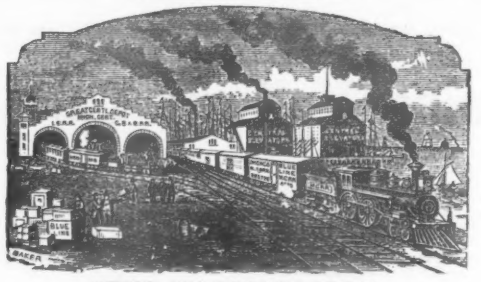
C. Shutter, Agent, 347 Broadway, New York. A. Cushman, Agent, Old State House, Boston, Mass

W. D. MANCHESTER, Agent, 54 Clark St., Chicago.

Great Central Route.

"BLUE LINE."

ORGANIZED JANUARY 1, 1867.

1870.  1870.

OWNED AND OPERATED BY THE

Michigan Central, Illinois Central, Chicago, Burlington & Quincy, Chicago & Alton, Great Western (of Canada), New York Central, Hudson River, Boston & Albany, and Providence and Worcester Railroads.

THE "BLUE LINE" is the only route that offers to shippers of freight the advantages of an unbroken gauge through from Chicago to the Seaboard, and to all Interior Points on the line of Eastern Connections beyond Suspension Bridge and Buffalo. All Through Freight is then transported between the most distant points of the roads in interest.

WITHOUT CHANGE OF CARS!

The immense freight equipment of all the roads in interest is employed, as occasion requires, for the through service of this Line, and has of late been largely increased. This Line is now prepared to extend facilities for the transit and delivery of all kinds of freight in Quicker Time and in Better Order than ever before.

The Blue Line Cars

are all of a solid, uniform build, thus largely lessening the chances of delay from the use of cars of a mixed construction, and the consequent difficulty of repairs, while remote from their own roads. The Blue Line is operated by the railroad companies who own it, without the intervention of intermediate parties between the Roads or Line and the public.

Trains run through with regularity **IN FOUR OR FIVE DAYS** to and from New York and Boston. Especial care given to the Safe and Quick Transport of Property Liable to Breakage or Injury, and to all **Perishable Freight.**

Claims for overcharges, loss or damage, promptly settled upon their merits. Be particular and direct all shipments to be marked and consigned *via*

"BLUE LINE."

☞ *FREIGHT CONTRACTS* given at the offices of the company in Chicago, New York and Boston.

J. D. HAYES, GEN. MANAGER,.. Detroit.

C. E. NOBLE,.... } 349 Broadway, N. Y. | P. K. RANDALL, 69 Washington St., Boston.
GEO. E. JARVIS,... } | W. W. STREET,.....91 Lake St., Chicago.
N. D. MUNSON,.....Quincy, Ill. | J. JOHNSON,.....Cairo, Ill.

THOS. HOOPS, GEN. FR'T AGT. Michigan Central Railroad, Chicago.
A. WALLINGFORD, AGT. M. C. & G. W. R. R., No. 91 Lake St., Chicago.
N. A. SKINNER, Freight Agent Michigan Central Railroad.

Empire Line.

THE EMPIRE TRANSPORTATION COMPANY'S

Fast Freight Line to the East

—AND—

TO THE COAL AND OIL REGIONS,

Via Michigan Southern, Lake Shore, and Philadelphia & Erie R. R.'s,

WITHOUT TRANSFER!

Office, No. 72 LaSalle Street, Chicago.

GEO. W. RISTINE, Western Superintendent, Cleveland, Ohio.

W. G. Van Demark,..265 Broadway, New York. | E. L. O'Donnell,.....Baltimore, Md.
G. B. McCulloh,....42 South 5th St., Philadelphia. | Wm. F. Smith,.....Erie, Penn

JOHN WHITTAKER, Pier 14 North River, New York.

JOSEPH STOCKTON, Agent, Chicago.

W. T. HANCOCK, Contracting Agent.
WM. F. GRIFFITTS, Jr., Gen. Freight Agent, Philadelphia.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Cedar Rapids Pass | **10:15 P. M. Night Mail.**
10:45 A. M. Pacific Express. | **10:15 P. M. Rock Island Pass.**
10:45 A. M. Rock Island Exp. | **4:00 P. M. Dixon Passenger.**

For Sterling, Rock Island, Fulton, Clinton. Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	70.75	" SAN FRANCISCO,	5	118.00

TRAINS ARRIVE:—Night Mail, **7.00** a. m.; Dixon Passenger, **11.10** a. m.; Pacific Express **4:15** p. m.; Rock Island Express, **4:15** p. m.; Cedar Rapids Passenger, **6:45** p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.

4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, **2:30** a. m., **3:00** p. m.; Rockford Accommodation, **11:10** a. m.; Geneva and Elgin Accommodation, **8:45** a. m.; Junction Passenger, **8:10** a. m.; Lombard Accommodation, **6:50** a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

4.00 P. M., Janesville Accommodation.

6.00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5.00 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.

TRAINS ARRIVE:—**5:30** a. m., **7:45** a. m., **1 :10** a. m., **1:00** p. m. and **7:15** p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,	**8:15 A. M.**
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,.....	**9:45 A. M. 5:00 P. M.**
EVANSTON PASSENGER,	**1:00 P. M.**
HIGHLAND PARK PASSENGER,	**1:15 P. M.**
MILWAUKEE ACCOMMODATION, with Sleeping Car attached.....	**11:00 P. M.**
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot.....	**6:15 P. M.**
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot.....	**4:10 P. M.**
AFTERNOON PASSENGER, from Milwaukee Div Depot.....	**5:45 P. M.**
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot.....	**5:25 P. M.**
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot.....	**5:00 P. M.**

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, **5:00** a. m.; Day Express, **4:10** p. m. Milwaukee Mail, **10:10** a. m.; Afternoon Passenger, **8:00** p. m.; Waukegan Accommodation. **8:2** a. m.; Kenosha Accommodation, **9:10** a.m.; Evanston Accommodations, **1.40** and **4.00** p. m.; Waukegan Passenger, **7:55** a. m.; Highland Park Passenger, **3.45** p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt.
GEO. L. DUNLAP, Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

☞ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ☜

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets **TO MILWAUKEE,** as this is the Great Distributing Point for these States.

A. V. H. CARPENTER, Gen. Pass. Agt. Milwaukee.
S. S. MERRILL, Gen. Manager, Milwaukee.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

☞ THE DIRECT ROUTE FOR ☜

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA,
Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,

Muscatine, Washington, Iowa City,
GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake, White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in **China, Japan, Sandwich Islands, Oregon and Alaska.**

☞ TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

	LEAVE.	ARRIVE.
PACIFIC EXPRESS, (Sunday excepted).....	**10.00 a. m.**	**4.15 p. m.**
PERU ACCOMMODATION, (Sundays excepted).....	**4.30 p. m.**	**9.45 a. m.**
PACIFIC EXPRESS, (Saturdays excepted,).....	**10.00 p. m.**	[Mon. ex. **7.00 a. m.**

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

☞ Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

☞ **For Through Tickets,** and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. **37** South Clark Street, Chicago, or **257** Broadway, New York.

A. M. SMITH, Gen. Pass. Agent. **HUGH RIDDLE,** Gen. Supt. **P. A. HALL,** Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route,

Now Completed and Open for Business Through to

DENVER, COLORADO.

There Connecting with the DENVER PACIFIC RAILROAD for CHEYENNE, forming, in Connection with the UNION and CENTRAL PACIFIC RAILROADS, another ALL-RAIL ROUTE to

CALIFORNIA, NEVADA, UTAH, MONTANA,

WYOMING, COLORADO, &C.

The most available Passenger and Freight Route to Lawrence, Topeka, Junction City, Abilene, Salina, Hays, KIT CARSON, River Bend, DENVER, CHEYENNE, OGDEN, SALT LAKE CITY,

Sacramento, and San Francisco.

☞ Close Connections are made in Union Depots at KANSAS CITY and STATE LINE with Express Trains of the HANNIBAL & ST. JOSEPH, NORTH MISSOURI and MISSOURI PACIFIC RAILROADS.

Southern Overland Passenger and Mail Coaches leave Kit Carson daily for Pueblo, Trinidad, Fort Union, Santa Fe, &c.

Hughes & Co.'s Splendid Concord Coaches leave Denver daily for Central City, Georgetown, &c.

Passenger and Freight Rates always as low and conveniences as ample as by any other Route.

PULLMAN'S PALACE CARS ACCOMPANY NIGHT EXPRESS TRAINS.

Through Tickets can be obtained at all principal ticket offices. Be careful to ask for tickets via Kansas Pacific Railway, "Smoky Hill Route."

5,000,000 Acres of Farming Lands For Sale!

Situated along the line of this Great National Railway. For particulars, address JNO. P. DEVEREUX, Land Commissioner, Lawrence, Kansas.

R. B. GEMMELL, Gen. Freight & Ticket Agt. **A. ANDERSON,** Gen. Supt.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

— TO —

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent.
D. A. OLIN, Gen. Superintendent.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy

RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2½	$63.00
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

Trains Leave Chicago from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. MAIL AND EXPRESS, (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC FAST LINE, (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.
☞ ELEGANT DAY COACHES and PULLMAN PALACE DRAWING ROOM CARS are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9.00 P. M. PACIFIC NIGHT EXPRESS, (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Burlington,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

7.40 A. M. MAIL AND EXPRESS (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Dunleith, Dubuque, La Salle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC EXPRESS, (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

9:00 P. M. PACIFIC NIGHT EXPRESS, (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY,

Kansas City, Lawrence, Topeka and Denver,

☞ WITHOUT CHANGE! ☜

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave

RIVERSIDE & HINSDALE ACCOMMODATION.7:00 A. M. 1:30 & 6:15 P.M
GALESBURG PASSENGER.....3:00 P. M.
MENDOTA PASSENGER.....4:15 P. M.
AURORA PASSENGER.....5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH

SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

This is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, Mo?
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, Mo.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave Chicago from the West-side Union Depot, near Madison Street Bridge. ☜

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	†5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	‡9:00 "	*7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

North Missouri R. R.

PASSENGERS FOR

KANSAS AND THE WEST,

ARE REMINDED THAT

THE NORTH MISSOURI R. R.

— IS —

11 MILES SHORTER than any other Route!

BETWEEN

St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

— AND —

49 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

C. N. PRATT, Gen. Eastern Agt., 111 Dearborn-st. CHICAGO.
S. H. KNIGHT, Gen. Superintendent, ST. LOUIS.

JAS. CHARLTON, Gen. Pass. and Ticket Agt., St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK, General Superintendent.

61 Miles the Shortest Line!

— FROM —

CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

— AND —

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains **THROUGH** to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,

PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

LEAVE:	Mail.	Fast Express.	Pacific Exp.	Night Exp.
CHICAGO	6.00 A. M.	11.00 A. M.	5.25 P. M.	9.00 P. M.
PLYMOUTH	10.08 "	2.03 P. M.	9.10 "	12.35 A. M.
FORT WAYNE	1.10 P. M.	3.45 "	11.35 "	3.20 "
LIMA	3.42 "	5.15 "	1.35 A. M.	5.35 "
FOREST	5.10 "	6.07 "	2.45 "	6.57 "
CRESTLINE	6.15 A. M.	7.40 "	4.30 "	9.35 "
MANSFIELD	6.58 "	8.05 "	5.00 "	10.05 "
ORRVILLE	9.20 "	9.42 "	6.57 "	11.55 "
ALLIANCE	11.30 "	11.05 "	8.50 "	1.30 P. M.
PITTSBURGH	8.10 P. M.	2.30 A. M.	1.00 P. M.	5.22 "
CRESSON	11.57 "	5.44 "	4.48 "	9.08 "
ALTOONA	12.48 A. M.	6.25 "	5.55 "	10.00 "
HARRISBURG	5.30 "	10.40 "	10.45 "	2.50 A. M.
MANTUA JUNCTION	9.30 "	2.00 P. M.	2.50 "	6.45 "
PHILADELPHIA	9.40 "	2.10 "	3.00 "	6.50 "
NEW YORK, VIA PHILADELPHIA	11.40 "	5.06 "	6.41 "	10.30 "
NEW YORK, VIA ALLENTOWN	1.00 P. M.	5.06 "		
BALTIMORE	9.30 A. M.	2.00 "	2.30 A. M.	
WASHINGTON	1.10 P. M.	5.00 "	5.45 "	
BOSTON	11.50 "	5.50 A. M.	5.05 "	9.00 P. M.

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

☞ All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, **Without Charge!**

THROUGH TICKETS for sale at the Company's Offices, at **65** Clark St.; **52** Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,

The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, Gen. Pass. & Tkt Agt. P. F.W. & C. R'y Chicago.

W. C. CLELAND, Gen. Western Pass. Agt. P. F. W. & C. R'y, Chicago.

T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!

ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!

From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

☞ The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,

AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

☞ **SLEEPING COACHES,** Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE,** accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, **wait from one to two hours for Western trains.**

All Trains of Saturday run directly Through to New York.

☞ **Ask for Tickets via Erie Railway,** which can be procured at **66 Clark Street,** Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, Gen'l Superintendent, New York.

A. J. DAY, Western Passenger Agent, Chicago.

WM. R. BARR, Gen'l Passenger Agent, New York.

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS.

[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS	3:00 A. M.	HARRISBURG	10:35 P. M.	NEW YORK	6:40 A. M.	WASHINGTON	5:45 A. M
PITTSBURGH	12:15 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE	2:30 A. M.	BOSTON	5:05 P. M

7:10 P. M. NIGHT EXPRESS.

[SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS	11:15 A. M.	HARRISBURG	5:20 A. M.	NEW YORK	11:40 A. M.	WASHINGTON	1:10 P. M
PITTSBURGH	7:25 P. M.	PHILADELPHIA	9.50 A. M.	BALTIMORE	9:30 A. M.	BOSTON	11:50 P. M

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati,
18 Miles the Shortest Route to Indianapolis and Louisville.

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Dayton, Wheeling, Zanesville, Parkersburg, Marietta, Evansville, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M. (Sundays excepted) Arriving at

LOGANSPORT	1:15 P. M.
KOKOMO	2:33 P. M.
CINCINNATI	10:10 P. M.
INDIANAPOLIS	5:00 P. M.
LOUISVILLE	11:30 P. M.

8.05 P. M. (Saturdays excepted.) Arriving at

LOGANSPORT	1:15 A. M.
KOKOMO	2:31 A. M.
CINCINNATI	9:35 A. M.
INDIANAPOLIS	5:40 A. M.
LOUISVILLE	8:50 P. M.

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus.

I. S. HODSDON Northwestern Pass. Agt. Chicago.

D. W. CALDWELL Gen Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

☞ THROUGH LINE! ☜

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at **OMAHA** with the Great **Union Pacific Railroad,** for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO

And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

☞ Ask for Tickets via the People's Favorite Route, **Kansas City, St. Joseph & Council Bluffs Railroad Line.**

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo.

A. C. DAWES, Gen. Passenger Agent, ST. JOSEPH, Mo.

LAKE SHORE
—AND—
MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN

CHICAGO, BUFFALO & NEW YORK,

WITHOUT CHANGE!

AND THE ONLY RAILWAY

RUNNING PALACE COACHES THROUGH!

—BETWEEN—

CHICAGO & NEW YORK, via BUFFALO

☞ WITHOUT TRANSFER OF PASSENGERS! ☜

All Trains Stop at Twenty-Second Street to Take and Leave Passengers. Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave Chicago from the New Depot, on Van Buren St., at the head of La Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 22d Street 7:45 A. M. Stops at all Stations. **Arrives**—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **9:15 A. M. Arrives**—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.: New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.

Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leaves—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes or Supper): arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (30 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 7:15 A. M.

9:00 P. M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:15 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:50 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.; Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.; Grand Rapids, 10:15 A. M.

☞ There being no heavy grades to overcome, or mountains to cross, the road bed and track being the smoothest and most perfect of any railway in the United States, this Company run their trains at a high rate of speed with perfect safety.

☞ Travelers who wish to SAVE TIME and make SURE CONNECTIONS, purchase Tickets via

LAKE SHORE & MICHIGAN SOUTHERN R'Y.

THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK CENTRAL RAILROAD and ERIE RAILWAY.

General Ticket Office for Chicago, No. 56 Clark Street.

CHAS. F. HATCH,
General Superintendent, Cleveland, Ohio

F. E. MORSE,
General Western Passenger Agent, Chicago.

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO
THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex.
Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted.
Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,

LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted.
Arriving at **Cairo** 2:15 A. M., **Memphis** 12:45 P. M., **Mobile** 9:25 A. M. **Vicksburg** 9:25 A. M., **New Orleans** 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at **Cairo** 12:24 P. M., **Memphis** 4:15 A. M., **Little Rock** 7:00 P. M., **Vicksburg** 8:10 P. M., **New Orleans** 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER,
Arriving at **Champaign** at 10:45 P. M.

☞ THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs, Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

☞ **NOTICE.—This Route is from 100 to 150 MILES SHORTER, and from 12 to 24 HOURS QUICKER than any other.**

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted.
Arriving at **Chenoa** 3:20 P. M., **El Paso** 4:08 P. M., **Peoria** 5:42 P. M., **Canton** 7:15 P. M., **Bushnell** 8:57 P. M., **Keokuk** 11:15 P. M., **Warsaw** 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

☞ For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

	Leave.	Arrive.		Leave.	Arrive.
HYDE PARK TRAIN,...	*8:30 A. M.	*7.45 A. M.	HYDE PARK TRAIN,....	*3:00 P. M.	*5:15 P. M
HYDE PARK TRAIN....	*8:00 A. M.	*9.20 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent. **M. HUGHITT, Gen. Supt.**

1870. Great Central Route! 1870.

SPEED! COMFORT! SAFETY!

MICHIGAN CENTRAL and GREAT WESTERN RAILWAYS!

The Great Central Route, via Niagara Falls, to

NEW YORK AND NEW ENGLAND.

Pullman's Magnificent Palace Drawing-Room Cars,

— FROM —

CHICAGO TO NEW YORK CITY, WITHOUT CHANGE.

4 PASSENGER TRAINS LEAVE CHICAGO, DAILY EXCEPT SUNDAY.
(DEPOT, FOOT OF LAKE STREET,) as Follows:

5:40 A. M. (SUNDAYS EXCEPTED.) MAIL TRAIN. Stops at all Stations.
Arrives DETROIT at 6:30 P. M.

9:00 A. M. (SUNDAYS EXCEPTED.) SPECIAL NEW YORK & BOSTON EXP.
Arrives at Michigan City 11:10 A. M.; Niles 12:40, [Dinner], Kalamazoo 2:15 P. M.; Battle Creek 3:00, Marshall 3:24, Jackson 4:30, Detroit 6:55; London 12:05, A. M Hamilton 2:35 A. M.; Toronto 10:00, Suspension Bridge 4:40, Rochester 7:15 A. M.; Albany, 2:25 P. M.; NEW YORK, 7:00, BOSTON, 11:45 P. M. ☞ This train connects at ROCHESTER (7:15 A. M.) with

Wagner's Magnificent Palace Drawing-Room Cars!

☞ RUNNING THROUGH TO NEW YORK, WITHOUT CHANGE! ☜

5:15 P. M. (DAILY.) ATLANTIC EXPRESS.
Arrives at Michigan City, 7:22 P. M.; Niles 8:5) P. M. [Supper]; Kalamazoo, 10:30 P. M.; Jackson, 1:05 A. M.; Detroit 3:45, London, 8:35, [Breakfast]; Hamilton 11:40, Suspension Bridge 2:35 P. M.; Rochester 5:10 P. M.; Albany, 1:50 A. M.; NEW YORK, 7:15 A. M.; BOSTON, 11:00 A. M. A MAGNIFICENT DRAWING-ROOM SLEEPING CAR is attached to this train daily, FROM CHICAGO TO NEW YORK CITY. The celebrated

☞ **Hotel Drawing-Room Car is also attached to this Train from Chicago to Rochester!** ☜

☞ These, together with **ELEGANT DAY CARS TO SUSPENSION BRIDGE,** make this Train the favorite Train for all points East.

SPECIAL NOTICE.—Boston and New England Passengers will please notice that this Train now makes direct connection through. A SLEEPING CAR is attached at Rochester at 5.20 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to **Connect with all Trains** up and down the Connecticut.

9:00 P. M. (SAT. & SUN. EXCEPTED). NIGHT EXPRESS.
Arrives at Michigan City, 11:10 P. M.; Niles, 12:28 A. M.; Kalamazoo, 2:10; Marshall, 3:25; Jackson, 4:45; Grand Trunk Junction, 7:30; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 6:25; Buffalo, 7:15 P. M.; Rochester, 9:05; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:35; Albany, 6:30 A. M.; NEW YORK, 12:00 M.; BOSTON, 3:50 P. M.

PULLMAN'S PALACE SLEEPING CARS ARE ATTACHED TO THIS TRAIN FROM CHICAGO TO DETROIT,
And from Suspension Bridge to New York.

WE INVITE THE ATTENTION OF THE TRAVELER to the SPLENDID EQUIPMENTS of this FIRST-CLASS LINE TO THE EAST!

☞ FOR THROUGH TICKETS, and any and all information, Sleeping Car accommodations, &c., apply at General Office in Tremont House Block, at office in Great Central Depot; also at No. 60 Clark street, under Sherman House; at Grand Trunk Railway Office, 48 Clark street, or at New York Central Railroad Office, No. 53 Clark street, and at office under Briggs House.

H. E. SARGENT, Gen. Supt. M. C. R. R. W. K. MUIR, Gen. Supt. Gt. Western R. W. HENRY C. WENTWORTH, Gen. Pass. Agt.

CHICAGO, INDIANAPOLIS & LOUISVILLE

THROUGH LINE!

—VIA—

MICHIGAN CENTRAL RAILROAD.

THE ONLY ROUTE TO

TO LOUISVILLE, WITHOUT CHANGE OF CARS.

TWO EXPRESS TRAINS Leave Chicago Depot, Foot of Lake as Follows:

9:00 A. M. (EXCEPT SUNDAY.) MORNING EXPRESS
Arriving at LaFayette, 2:25 P. M.; Indianapolis, 6:00 P. M; Louisville, 11:30 P. M.

4:30 P. M. (EXCEPT SATURDAY) AFTERNOON EXPRESS
Arriving at Michigan City 6:20 P. M. [Supper]; LaFayette, 11:30 P. M. Indianapolis, 2:15 A. M.; Louisville, 7:00 A. M.; Nashville, 4.00 P. M.

A GOOD SLEEPING CAR is Attached to this Train Every Night,
And goes from Chicago to Louisville WITHOUT CHANGE!

☞ **SPECIAL NOTICE.**—This Train stops at Michigan City for Supper, and waits at that point for Michigan Central Atlantic Express East, leaving Chicago at 4:45 p. m. Passengers going South, and wishing as much time in Chicago as possible, can take the 4:45 p. m. Michigan Central Atlantic Express, and connect without fail at Michigan City, with above Through Louisville Express.

☞ **THE GREAT BRIDGE ACROSS THE OHIO** at Louisville being completed, passengers are relieved of the omnibus transfer.

FOR THROUGH TICKETS, via this line, apply at offices of connecting lines and at all Ticket offices in Chicago.

HENRY C. WENTWORTH, Gen. Pass. Agent.

Michigan Central R. R.

LOCAL CONNECTIONS:

Chicago & Michigan Lake Shore Railroad.
Open from New Buffalo to St. Joseph, Mich.
5:00 A. M. AND 4:30 P. M. Trains from Chicago Connect at New Buffalo.

Kalamazoo, Allegan & Grand Rapids R. R.
Open to Grand Rapids.
11:30 A. M. AND 9:00 P. M. Trains from Chicago Connect at Kalamazoo

Peninsular Railroad of Michigan.
Open to Charlotte.
5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Battle Creek.

Jackson, Lansing & Saginaw Railroad.
Open to Bay City, Mich. Passing through Lansing and Saginaw.
5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Jackson.

GRAND TRUNK RAILWAY.

All Michigan Central Trains Connect at Grand Trunk Junction
— FOR —
SARNIA, TORONTO, MONTREAL,
PORTLAND, BOSTON, BUFFALO, OGDENSBURG
AND ALL POINTS EAST.

H. E. SARGENT, General Superintendent.

JACOB R. SHIPHERD & CO.,

155 and 157 LaSalle Street,

CHICAGO.

RAILWAY BANKERS

NEGOTIATE

MORTGAGE BONDS,

And Local Bonds issued in Aid;

Make Advances; Complete Unfinished Roads, etc., etc.

Rand, McNally & Co.,

[TRIBUNE JOB OFFICE]

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PRINTERS, STATIONERS,

ENGRAVERS,

—AND—

Blank Book Manufacturers

IN THE WEST.

Railroad Printing and Stationery a Specialty.

Consecutively Numbered Railroad Tickets,

Ticket Cases, Conductors' Punches,

DATING PRESSES, CANCELING STAMPS,

Etc., Etc., Etc.

49, 51 and 53 Clark Street,

CHICAGO.

Established 1852.

CLEVELAND FILE WORKS

CLEVELAND, OHIO.

All descriptions of Files Manufactured and Recut. Also, dealers in *Best English Cast Tool Steel.* Orders solicited and satisfaction guaranteed. JOHN PARKIN, Prop'r.

NEWS DEALERS

Should Address Orders for

THE RAILROAD GAZETTE,

— TO —

The Western News Company,

CHICAGO.

IMPORTANT DISCOVERY!

"A COPYING PRINTERS' INK,"

[McILVAINE'S PATENT.]

Peculiarly adapted for

Manifests, Bills of Lading, Bank Circulars, Reports and Statements of Accounts Current, Letter Heads, &c.

Yielding as PERFECT AN IMPRESSION as that of the BEST COPYING INK for writing purposes—the use of the two in connection filling a want never heretofore supplied.

HELFENSTEIN & LEWIS,

Railroad and Commercial Printing Rooms.

Corner of Fifth and Chestnut Streets,

PHILADELPHIA.

☞ Specimen impressions furnished on application.

BENOIT & WOOD,

Manufacturers and Importers of

Artists' Materials!

Drawing Paper, Mathematical Instruments, Architects' and Engineers' Supplies, Patented T Squares, Triangles and Straight Edges.

148 FULTON STREET, NEW YORK.

HARRISBURG

CAR MANUFACTURING CO.,

Harrisburg, Pennsylvania,

MANUFACTURE

Passenger, Mail, Baggage, Box Gondola, Coal,

AND ALL OTHER KINDS OF

RAILROAD CARS!

Railroad Car Wheels & Castings,

Bridge & Rolling Mill Castings,

Bridge Rods, Bolts,

—AND—

RAILROAD FORGINGS!

W. T. HILDRUP, *Superintendent.*

WILLIAM COLDER, *President.*

HARRISBURG

Foundry and Machine Works!

(Branch of Harrisburg Car Mfg Co.,)

Harrisburg, - - Pennsylvania.

MANUFACTURERS OF

MACHINISTS' TOOLS!

— SUCH AS —

LATHES, PLANERS,

Shaping and Slotting Machines, Bolt Cutting & Nut Tapping Machines, &c.

W. T. HILDRUP, *Treasurer.*

PHŒNIXVILLE BRIDGE WORKS.

Clarke, Reeves & Co.,

Successors to Kellogg, Clarke & Co.,

Engineers & Iron Bridge Builders,

OF PHŒNIXVILLE, PA.,

Will henceforth have their Principal Business Office at 410 Walnut St., Philadelphia, to which all correspondence should be addressed. Circulars, plans and prices sent on application.

IRON BRIDGES, PIVOT BRIDGES

—AND—

Turn Tables.

F. C. LOWTHORP,

Civil Engineer, Patentee & Builder,

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